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B

Scientific Sessions (B)

Session numbers are prefixed by SS.
Presentation numbers are prefixed by the letter B.
Sessions and abstracts are listed by days.

Thursday, March 6

10:30 - 12:00 **Room B**

Abdominal Viscera

SS 101

Pancreas and biliary system

Moderators:
M. D'Onofrio; Verona/IT
D. Negru; Iasi/RO

B-0001 10:30

Assessing the viability of human pancreas grafts using ^{31}P MR spectroscopy

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Purpose: In order to select pancreas suitable for transplantation an objective non-invasive assessment of graft viability is desirable. ^{31}P magnetic resonance spectroscopy (^{31}P-MRS) has previously been applied for pancreas graft evaluation in animal models, with promising results. The aim of this pilot study was to investigate the feasibility of using ^{31}P-MRS for assessment of human pancreas graft viability prior to transplantation.
Methods and Materials: Pancreata from five human donors were included. Immediately after removal from the donor each pancreas was perfused with histidine-tryptophan-ketoglutarate (HTK) solution and stored in hypothermic condition (4°C). ^{31}P-MRS was performed on a 1.5 T clinical MR scanner, using an ISIS sequence. Typical voxel size was ~5×5×14 cm^3. The first spectrum was acquired 6-10 hours after HTK perfusion start. During the following 17-25 hours subsequent spectra were obtained by repeated examinations, while preserving the hypothermic environment. Thereafter the pancreas was exposed to room temperature for 24 hours and the last spectrum was measured. This spectrum served as a reference for non-viable tissue. The following metabolites were fitted: phosphomonoesters (PME), inorganic phosphate (Pi), phosphodiesters (PDE), phosphocreatine (PCr), and adenosine triphosphate (ATP).
Results: γ-ATP and β-ATP lines decreased to the noise level within 2-4 hours after the start of ^{31}P-MRS. PME, PDE and α-ATP levels gradually decreased and Pi increased. Non-viable pancreas tissue revealed dominant Pi and small PME and PDE intensities.
Conclusion: (γ-ATP+β-ATP)/Pi, PME/Pi and PDE/Pi spectral intensity ratios obtained by ^{31}P-MRS are promising quantitative parameters for objective non-invasive assessment of the viability of human pancreas grafts.

B-0002 10:39

Utility of DWI sequences in autoimmune pancreatitis before and after steroid therapy

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Purpose: To evaluate the utility of Diffusion Weighted (DWI) sequences in Autoimmune Pancreatitis (AIP) and to identify typical values of apparent diffusion coefficients (ADC) before and after steroid therapy.
Methods and Materials: Between February 2010 and April 2013 we evaluated retrospectively 35 Magnetic Resonance examination with Diffusion Weighted Imaging (DWI) Sequences in 25 patients with diagnosis of AIP (19 men, 6 women, mean age 45.7 years). Ten out of 25 patients performed MRI before and after steroid therapy, 3/25 only before and 12/25 only after therapy. Two Radiologists separately analysed each exam, evaluating the signal ntensity of the affected parenchyma in T1-weighted and DWI sequences and measuring ADC values, through circular region of interest.
Results: In the acute phase AIP appeared hypointense in T1 sequences in 13/13 (100%) and hyperintense in 11/13 (84.6%) patients, with an ADC value of 1.12±0.19x10^{-3} mm^2/s; after steroid treatment the signal intensity remained hypointense on T1 sequences in 16/22 (72.7%) and decreased in DWI in 17/22 patients (77.3%) with an ADC of 1.44±0.16x10^{-3} mm^2/s, statistically different from the acute phase value (p=0.0002).
Conclusion: AIP shows a low signal intensity on T1 sequences, an high signal intensity on DWI and a low ADC value in the acute phase. After steroid treatment, signal intensity on T1 sequences remains low in the most of the cases, but intensity signal in DWI decreases and ADC value increases, reflecting disease activity. DWI and ADC are qualitative and quantitative complementary parameters in evaluation of response to treatment in AIP.

B-0003 10:48

Stenosis of the main pancreatic duct in focal form of autoimmune pancreatitis: imaging findings on MR-MRCP

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Purpose: To retrospectively evaluate the MR imaging-MR cholangiopancreatographic (MRCP) findings of focal forms of autoimmune pancreatitis (AIP) and to describe ductal system involvement at diagnosis.
Methods and Materials: MR examinations of 123 patients affected from AIP were considered for inclusion. Out of these cases, we included 26 patients who satisfied International Consensus Diagnostic Criteria and were suffering from focal form of AIP. MRI was performed as a technique for the first diagnosis; all the patients who underwent other imaging techniques were excluded. Image analysis included: site of pancreatic parenchymal enlargement, signal intensity abnormalities, pancreatic enhancement, main pancreatic duct (MPD) diameter, MPD stenosis, presence of upstream and side branches dilation.
Results: signal intensity abnormalities were localised in the head in 10/26 (38.5%) patients, in the body-tail in 16/26 (61.5%) patients. Lesions showed hypointensity on T1-weighted images in all 26 patients, hyperintensity on T2-weighted images in 22/26 (84.6%) cases. The affected parenchyma was hypovascular during the arterial phase in 25/26 (96.2%) patients with contrast retention in all patients. MRCP study showed a single MPD stenosis in 12/26 (46.1%) patients and multiple stenoses in 14/26 (53.8%), without an upstream dilation of the MPD (mean value: 3.83 mm).
Conclusion: MR and MRCP are effective technique for the diagnosis of AIP, through the finding of indicative signs of the disease, such as the absence of the physiological lobulation and the typical contrastographic appearance, (hypovascular during arterial phase with progressive retention of contrast). The presence of multiple stenoses at MRCP suggests the diagnosis of AIP.

B-0004 10:57

Indication to the use of secretin-enhanced MRCP: experience of a single large referral center

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Purpose: To retrospectively evaluate the diagnostic utility of secretin-enhanced MR cholangiopancreatography (S-MRCP) in various pancreas conditions.
Methods and Materials: 314 S-MRCP examinations performed on 299 patients in our center in 2012 were analysed. We evaluated the diagnostic role of S-MRCP in patients with suspected or diagnosed chronic pancreatitis, severe acute pancreatitis, pancreatoduodenectomy, asymptomatic pancreatic hyperenzymaemia, suspected solid or cystic tumour. MRCP findings before and after Secretin administration were compared.
Results: S-MRCP compared to MRCP found 34.2% (49/143) additional patients with mild-chronic pancreatitis ($P < 0.01$); in 71 patients with already diagnosed chronic pancreatitis secretin was useful to assess pancreatic exocrine reserve (70% Sensibility, 95% Specificity) and to evaluate the efficiency of pancreatic sphincterotomy (performed in 16/71 patients, 22.5%); S-MRCP found pancreatic leakage in 12.5% of Patients (3/24) with acute pancreatitis (P=0.23); S-MRCP found anastomotic stenosis in 33.3% of patients with pancreatoduodenectomy (3/9, P=0.21); in the group with asymptomatic hyperenzymaemia S-MRCP showed mild-chronic pancreatitis in 66.7% of patients (8/12, $P < 0.01$); in 17 patients with main pancreatic duct stenosis S-MRCP differentiated inflammatory pancreatic mass from pancreatic carcinomas (100% Sensibility, 92% Specificity). In 19 patients with suspected cystic tumour S-MRCP was not diagnostically superior to MRCP.
Conclusion: Secretin-enhanced MRCP gives valuable information of the function and anatomy of the pancreas. It is useful to detect signs of mild-chronic pancreatitis, assess pancreatic exocrine reserve, demonstrate pancreatic leakage, evaluate results of pancreatoduodenectomy and sphincterotomy, differentiate inflammatory pancreatic mass from pancreatic carcinomas.

B-0005 11:06

Pancreatic steatosis in a population-based study and its clinical relevance determined by magnetic resonance imaging

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Purpose: To assess the pancreatic fat content and to investigate its clinical relevance within a population-based study using a quantitative confounder-corrected MRI method to measure tissue proton density fat-fraction (PDFF).
Methods and Materials: MRI was performed at 1.5 T including a multi-echo chemical shift-encoded sequence. PDFF-maps were calculated after correction for T1-bias, T2*-bias, multi-peak spectral complexity of fat and noise bias. A fat phantom was constructed to evaluate the PDFF over the range from 0 to

100%. In addition, 1,367 asymptomatic volunteers, consistent of 633 men 743 women, with a median age of 50 years were grouped into non-diabetics (1083), prediabetics (208) and non-treated type 2 diabetics (76) following the oral glucose tolerance test. PDFF was assessed in pancreatic head, body and tail for each subject. Multi-variate analysis was performed to compare PDFF with demographic factors, behavioural factors and laboratory data associated with the metabolic syndrome.
Results: There was excellent agreement between fat content of phantom and PDFF (r2=0.989) with no differences in slope (p=0.471) and intercept (p=0.449). In volunteers, the mean-adjusted pancreatic fat content was 4.4% (head 4.6%; body 4.9%; tail 3.8%; being unequally distributed, p=0.0008). There was no significant difference between non-diabetic, prediabetic and type 2 diabetic subjects (p=0.757). Pancreatic PDFF was correlated with age, body mass index (BMI) and serum lipase activity, however ($P < 0.001$).
Conclusion: MRI is a useful tool to quantify the pancreatic steatosis. Pancreatic fat is not related to prediabetes and diabetes, which implicates a limited clinical relevance in the content of the glycaemic status.

B-0006 11:15

MDCT based volumetric analysis for evaluation of pancreas regeneration following distal pancreatic resection

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Purpose: To analyse pancreatic volume after distal pancreatic resection using a semi-automatic volume software and MDCT-scans.
Methods and Materials: Residual pancreatic volumes of 25 patients who had undergone distal pancreatic resection (for benign and malignant reasons) were determined 2 weeks, 8 weeks, and 6 months after surgery. CT scans were obtained in the portal-venous phase (5 mm, 256-slice CT scanner). A semi-automatic volume analysis software with" tumor-tracking" function was used.
Results: Pancreatic volume was determined semi-automatically within 5 minutes for one examination. Mean pancreatic volume of 25 patients (mean age 63.0 years) was 33.9 ml, 39.2 ml, and 40.5 ml; 2 weeks, 8 weeks, and 6 months after surgery, respectively. Significant increase of pancreatic volume was already seen 8 weeks after surgery (Wilcoxon's signed rank, p=0.001*). Six months after surgery pancreatic volume was significantly higher than 2 weeks after surgery (Wilcoxon's signed rank, p=0.002*). Thus, between 8 weeks and 6 months after surgery further volume increase was found *(p=0.0004*).*
Conclusion: MDCT based volumetric analysis is a fast and suitable method for evaluation of pancreas volume following distal pancreatic resection. Furthermore, pancreas volume shows a tendency to increase already 8 weeks after surgery.

B-0007 11:24

Detection of active bile leak with Gd-EOB-DTPA-enhanced MR cholangiography: comparison of 20-25 min delayed and 60-180 min delayed images

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Purpose: To assess the value of contrast-enhanced magnetic resonance cholangiography (MRC) performed in different time delays after injection of gadoxetic acid disodium (Gd-EOB-DTPA) for the diagnosis of active bile leak.
Methods and Materials: This retrospective analysis included Gd-EOB-DTPA-enhanced MR images of 34 patients suspected of bile leak. Images were acquired 20-25 min after Gd-EOB-DTPA injection. If there was inadequate contrast in the bile ducts, then delayed images after 60-90 min and 150-180 min were obtained. Results were correlated with intraoperative findings, ERCP results, clinical data, laboratory tests, and follow-up examinations.
Results: Gd-EOB-DTPA-enhanced MRC yielded an overall sensitivity of 96.4%, specificity of 100% and accuracy of 97.1% for the diagnosis of an active bile leak. The sensitivity of 20-25 min delayed MR images was 42.9%, of combined 20-25 min and 60-90 min delayed images was 92.9% and of combined 20-25 min, 60-90 min and 150-180 min delayed images was 96.4%.
Conclusion: Gd-EOB-DTPA-enhanced MRC utilising delayed phase images was effective for detecting the presence and location of active bile leaks. The images acquired 60-180 min post-injection enabled identification of bile leaks even in patients with a dilated biliary system or moderate liver dysfunction.

B-0008 11:33

Xanthogranulomatous cholecystitis: which is the best image tool to differentiate it from gallbladder carcinoma?

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Purpose: To evaluate diagnostic performance and common findings of high-resolution ultrasound (HRUS), CT, MRI to differentiate xanthogranulomatous cholecystitis (XGC) from early flat-type gallbladder (GB) cancer.
Methods and Materials: From January 2000 to May 2012, patients with surgically proven XGC (n=40) and early GB cancer (T1 or T2) with flat or infiltrative type (n=46), who underwent at least one imaging study amongst the HRUS (combined low- and high-MHz transducers, n=43), CT (n=83), or MRI (n=34) were included this study. Two radiologists independently and retrospectively estimated the possibility of XGC or GB cancer in each imaging modality using a five-point scale. They also evaluated the presence or absence of predefined abnormal findings of the gallbladder on HRUS, CT, and MRI. Statistical analyses were performed using ROC analysis and Fisher's exact test.
Results: AUCs of HRUS, CT and MR to differentiate XGC from GB cancer were more than 0.8 in R1 and R2 with moderate to excellent agreement. Statistically common HRUS findings for XGC included diffuse and smooth wall thickening, intramural nodule, gallstone, and collapsed GB ($p < 0.01$). Statistically common CT findings for XGC included diffuse and smooth wall thickening, continuous mucosa, intramural nodule, heterogeneously thick single layer, transient hepatic attenuation difference, and pericholecystic infiltration ($p < 0.01$). Statistically common MRI findings for XGC included diffuse wall thickening, continuous mucosa, intramural nodule, heterogeneously thick single layer, and transient hepatic signal difference ($p < 0.01$).
Conclusion: All three modalities of HRUS, CT and MRI showed comparable performance for distinguishing XGC from GB cancer using specific imaging findings.
Author Disclosures:
B. Choi: Consultant; Research Consultant, Samsung Electronics Co. Ltd.

B-0009 11:42

Dual-energy CT of the pancreas: improved carcinoma-to-pancreas contrast with a novel mono-energetic reconstruction algorithm

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Purpose: To evaluate a novel mono-energetic reconstruction algorithm with improved noise reduction for dual-energy CT of the pancreas.
Methods and Materials: 35 patients with suspected pancreatic carcinoma underwent dual-source dual-energy CT with arterial phase. Images were reconstructed as virtual 120 kV series (M_0.6) and with the standard mono-energetic application at 40 keV and 55 keV. Additional image series were reconstructed with the novel "mono-energetic plus" application promising improved noise reduction (40+ and 55+). Image quality was compared between all series with respect to noise, pancreas signal, SNR and pancreas-to-lesion contrast.
Results: 12 carcinomas were detected. Compared to the standard M_0.6 series signal of healthy pancreas tissue was significantly higher for all mono-energetic reconstructed images. With the standard mono-energetic algorithm noise increased with lower energies (55: 20 HU; 40: 41 HU), while the novel algorithm was able to keep the noise at a constantly low level (7 HU for 55+ and 40+) with no significant differences to the M_0.6 series (9 HU). SNR of the pancreas was significantly superior in the 40+ and 55+ than in the 40 and 55 standard series (35.5 and 20 vs. 7 and 8) and outperformed the M_0.6 series (9.5). Likewise, pancreas-to-lesion contrast was highest in the 40+ series (12) and thus significantly higher than in any of the other series (M_0.6: 2; 40: 1; 50: 2; 55+: 5).
Conclusion: A novel algorithm for mono-energetic reconstructed dual-energy CT data can significantly improve image quality in the diagnosis of pancreatic carcinoma.

B-0010 11:51

Imaging findings of ischemic cholecystitis following transarterial chemoembolisation prior to liver transplantation for hepatocarcinoma

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Purpose: To identify imaging features helping diagnose ischemic cholecystitis (IC) consecutive to transarterial chemoembolisation (TACE).
Methods and Materials: A retrospective review of TACE procedures prior to treat hepatocarcinoma was performed including 46 patients (35 transplanted, 2 died, 9 on the waiting list for liver transplantation). Post TACE US/MRI-derived features were correlated to the final diagnosis based on pathologic analysis (35) or biological and clinical follow-up (11). Following were considered at US/MRI: wall thickening (3 mm), gallbladder distension (short axis> 4 cm), pericholecystic fluid and infiltration, striated wall, wall irregularities, at MRI: T1 hypersignal of the gallbladder wall on unenhanced sequence, T1 hyperattenuation of the gallbladder wall and/or of the adjacent liver parenchyma on Gd-enhanced sequence, at Sonography: Murphy sign, increased colour Doppler signal of the gallbladder wall. Scott's pi was used to assess inter-modality agreement. A logistic regression was performed to identify imaging features which contribute significantly to the prediction of IC.
Results: IC was diagnosed in 12 patients. The most common features (frequency/Se/Sp) were wall thickening (91%/83%/91%), striated wall (82%/74%/96%), and wall irregularities (73%/75%/95%). Spontaneus hypersignal T1 signal of the gallbladder wall has a sensitivity and specificity of 66 % and 100%, respectively. These features were significantly more present in positive patients ($p < 0.005$). Within a logistic model, they predict IC with a good performance level (Youden index=0.91). Imaging-Pathology agreement was good (pi=0.8) as well as US-MRI agreement (0.6<pi< 0.8).
Conclusion: A model based on three imaging features may allow predicting acute ischemic cholecystitis with US or MRI.

10:30 - 12:00 **Room C**

Cardiac

SS 103

Acute chest pain, prognosis and risk stratification

Moderators:
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B-0011 10:30

Challenges in the use of a computed tomography imaging-based cardiovascular risk assessment tool in routine practice

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Purpose: Incorporation of a CT-based cardiovascular disease (CVD) risk score into clinical practice may complement standard conventional risk factors-based strategies in cardiovascular risk screening. The current study evaluates the potential barriers to the introduction of the CT-based CVD risk score in daily practice.
Methods and Materials: We conducted a pilot study among referring physicians, radiologists and general practitioners (GP) involved in the application of the CT based CVD risk score. Hundred traumatology patients who underwent chest CT scanning in the UMC Utrecht were included. Adherence percentages of the referring physicians and radiologists to the regular and correct application of the CT based CVD risk score were assessed. Additionally, the GPs attitudes towards follow-up of the CT based CVD risk score result in primary prevention setting were evaluated.
Results: Among the clinicians referring the patient for CT scanning 18% specifically requested for CVD risk assessment and 42% conveyed the CVD risk to the GP. Only 32% of the radiologists assessed the CVD risk score although it was specifically requested. Among the GPs 14% were negative towards follow-up of the CVD risk score result in primary prevention setting.
Conclusion: In current daily practice, there are certain barriers that need to be reduced to make the implementation of the routine use of the CT based CVD risk score realizable. Main deficiencies identified are: unfamiliarity and incorrect application of the CT-based CVD risk score, unawareness about the significance of CVD risk prevention in general, financial- and time constraints.

B-0012 10:39

Prognostic significance of cardiac magnetic resonance Imaging in patients with acute chest pain, elevated cardiac enzymes and a negative coronary angiogram

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Purpose: To assess the prognostic value of cardiac MRI in patients with acute chest pain, elevated cardiac enzymes and a negative coronary angiogram.
Methods and Materials: In a 51 months period, 152 patients allocated by the chest pain unit could be included in this study. Based on consensus reading of all available clinical, laboratory and imaging data, there were 54 patients with myocarditis, 27 patients with dilative cardiomyopathy, 21 patients with ischemic cardiomyopathy, 15 patients with Tako-Tsubo cardiomyopathy and 17 patients with a hypertensive cardiomyopathy. Furthermore we detected miscellaneous other cardiac diagnoses (e.g. tachymyopathy, hypertrophic cardiomyopathy or non-compaction cardiomyopathy n = 18). CMRI enabled correct assignment of diagnosis in 90 % of cases. All patients could be followed up either by telephone call or by patients' medical record after a mean of 50 months. Primary endpoints were the occurrence of MACE (death, stroke, heart failure, recurrent hospitalisation), secondary endpoints were the initiation of an interventional respectively operative procedure or a continuous medical therapy.
Results: Primary and secondary endpoints were reached most often in patients with dilative cardiomyopathy, non-compaction cardiomyopathy and tachymyopathy compared with all other diagnoses ($p < 0.01$), followed by patients with hypertensive heart disease. The most favorable prognosis had patients with Tako-Tsubo cardiomyopathy and patients with myocarditis.
Conclusion: CMRI helps establishing the final diagnosis in patients with acute chest pain, elevated cardiac enzymes and a negative coronary angiogram in the vast majority of cases and is of prognostic significance.

B-0013 10:48

Usefulness of CT angiography in low and moderate cardiovascular risk patients with chest pain admitted to emergency room in multimodal hospital

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Purpose: The purpose of the study was to evaluate usefulness and safety angio-CT in patients admitted to the ER with chest pain. Angio-CT was gatekeeper to invasive procedures or non-invasive treatment.
Methods and Materials: The prospective study covered 206 patients (mean age 66 +/- 15, 109 F) admitted to the ER with chest pain and low to intermediate cardiovascular risk. Patients were randomly assembled into two subgroups. Treatment in Group A comprised of risk assessment and invasive diagnostics, if necessary (102 pts, 55 F). Group B (104 pts, 52 F) patients underwent contrast CT-angiography with prospective ECG gating (triple rule out protocol) appended to the routine proceeding.
Results: In group A, 104 DSCT were performed and subsequently 30 patients underwent coronary angiography (24 PCI, 4 CABG, 2 muscular bridges). In 74 cases, coronary stenosis as a cause of chest pain was excluded and patients after short clinical observation were discharged or relegated to another specialist (due to additional findings). Among 1,096 coronary segments, 92 (8.3%) were nonevaluable (mostly distal parts and small branches). Effective radiation dose was for DSCT 10.4+/4.2 mSv. In the period of follow-up (mean 342+/-65 days), there were no hospitalisations due to bias in coronary assessment in CT. DSCT as a diagnostic procedure demonstrated discriminative value: area under ROC curve 0.977 for 0.95 confidence interval and p<0.002. Sensivity 100%, Specificity 95.4%, PPV 89% and NPV 100%. In group B: In 101 patients conventional coronary angiography and next 35 PCI and 6 CABG were performed. In 60 cases CCA was negative.
Conclusion: DSCT helps to avoid unnecessary invasive procedures due to coronary stenosis exclusion.

B-0014 10:57

Coronary risk stratification in asymptomatic population: impact of cardiac CT

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Purpose: To demonstrate the impact of cardiac CT (CTCA) in the stratification of cardiovascular risk in a population of asymptomatic patient with classic risk factors for coronary artery disease (CAD) compared to the systematic coronary risk evaluation (SCORE).
Methods and Materials: We included 123 asymptomatic patients (97 men/ 26 women; age 51.3 ±7.2) who underwent CTCA after clinical evaluation during which a risk for cardiovascular events in 10 years with the SCORE was calculated. Calcium score was also evaluated. Three possible outcomes were hypotised: patient with no CAD, patients with non-significant coronary stenosis,

and patients with significant coronary stenosis. On the basis of CACA results, we developed a simulation model to evaluate the effect on patient management.
Results: The pretest risk of cardiovascular events in the asymptomatic population was 1.06%. The average value of calcium score was 56.48 ± 176.61 (moderate risk). We found 17 patients with significant coronary stenosis who underwent coronary revascularisation. Over 50 patients with non-significant coronary stenosis began a medical treatment with statins. The average risk for cardiovascular events was 0.42 ± 0.66 after a cardiac CT exam.
Conclusion: We demonstrated an hypothetical reduction of the average risk for cardiovascular events using cardiac CT.

B-0015 11:06

The incremental prognostic value of dual-source computed tomography coronary angiography in subjects with suspected or known coronary artery disease

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Purpose: To assess incremental prognostic value of double-source computed tomography (DSCT) coronary angiography over clinical data in patients with known or suspected coronary artery disease.
Methods and Materials: Clinical and DSCT data were analysed in 311 consecutive patients who were scheduled for DSCT coronary angiography. DSCT angiograms were assessed for presence, luminal stenosis severity, location, and type (non-calcified, mixed or calcified) of coronary atherosclerotic plaques. 311 patients (164 males, mean age 54.0±8.1 years) were followed-up for 18.3±4.0 months. Cardiac events (cardiac death, non-fatal myocardial infarction (MI), revascularisation and cardiac hospitalisations were related to clinical and DSCT data. Cox proportional-hazards model was applied in stepwise forward fashion to identify predictors of outcome.
Results: Coronary plaques were found in 197 patients. Cardiac events occurred in 25 patients (2 cardiac deaths, 3 MI, 8 revascularisations, 15 hospitalisations). Independent predictors of subsequent events were diabetes mellitus, prior MI, coronary plaque, and ≥50% left main stenosis. In sequential Cox models predictive power of clinical model was strengthened by DSCT data ($p < 0.05$).
Conclusion: DSCT coronary angiography enhances prognostic value of clinical data in patients with suspected or known coronary artery disease.

B-0016 11:15

Anatomic vs functional testing in patients with chronic chest pain syndrome: a cost-effectiveness analysis

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Purpose: Improvements in Coronary CT angiography (CTA) have led to debate about whether anatomic or functional testing is more cost-effective in patients with suspected obstructive coronary artery disease (CAD). We simulated clinical outcomes and costs of CTA and functional testing.
Methods and Materials: We developed a Markov model to simulate CAD progression and mortality in 3,719 patients from the Ottawa Cardiac CT Registry. We compared no testing (SOC) to CTA (CTA), stress-EKG/stress-echo/SPECT (in 20%, 50%, and 30% of the cases) (FT), FT followed by CTA (FT-CTA) and CTA followed by FT (CTA-FT).
Results: In our population (age 58 years, 52% male, 68% moderate NCEP, 9% high NCEP) the prevalence of CAD was 14% obstructive (54% non-obstructive). FT correctly identified 11% (13%) at costs of $848/patient; CTA 12% (52%), CTA-FT 10% (52%), FT-CTA 10% (12%) at $892, $762, and $681 per patient, respectively. The model predicted an average remaining life expectancy of 16.33 quality adjusted life years (QALY) for SOC and 16.44, 16.46, 16.44 and 16.44 QALYs for FT, CTA, CTA-FT, and FT-CTA, respectively. This resulted in incremental cost-effectiveness ratios (ICER) of $19,500/QALY for FT-CTA compared to SOC, and $24,300/QALY for CTA vs. FT-CTA; FT and CTA-FT were both dominated. When including treatment for non-obstructive CAD, life expectancy increased by 0 to 0.6 QALYS depending on the percentage of non-obstructive CAD diagnosed; CTA cost-effectiveness improved to $5,000/QALY; the other strategies were dominated.
Conclusion: Preliminary analyses indicate that CTA is cost-effective for initial evaluation of patients with chronic chest pain.

B-0017 11:24

Prognostic value of cardiac CT in a asymptomatic population: 2-years follow-up

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Purpose: To evaluate the prognostic value of cardiac CT in a population of symptomatic patients with intermediate risk of coronary heart disease.
Methods and Materials: One hundred twenty-three asymptomatic patients with intermediate cardiovascular risk underwent CT coronary angiography (CTCA). Calcium score was also evaluated. Patients were classified in three groups: patients with no CAD, patients with non-significant coronary stenosis, patients with significant coronary stenosis according to CTCA results. Development of major cardiac events (cardiac death, non-fatal myocardial infarction, and unstable angina requiring hospitalisation, coronary revascularisations) or worsening of clinical conditions was evaluated for a 2-year period.
Results: None of the patients included in the "no CAD" group (51%) developed major cardiac events in 2 years. All patients (13.8%) with significant coronary stenoses underwent revascularisation within 6 months. Half of the patients with non-significant coronary stenoses (17% of the initial population) developed symptoms (70% stable angina, 30% unstable angina). The overall rate of major cardiac events (revascularuisation and unstable angina) was 23.8%.
Conclusion: Multislice CT showed a high prognostic value in patients with intermediate risk for coronary heart disease. In particular, the prognosis of patients with negative cardiac CT for coronary heart disease was excellent at 2-years follow-up.

B-0018 11:33

Residents' performance in the interpretation of on-call "triple-rule-out" CT studies in patients with acute chest pain

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Purpose: To evaluate the agreement between preliminary Radiology resident and final subspecialty attending interpretation of on-call, emergency "Triple-Rule-Out" (TRO) CT studies in patients with acute chest pain.
Methods and Materials: The study was IRB-approved and HIPAA compliant. Data from 617 on-call TRO studies were analysed. Dedicated software enables subspecialty attendings to grade discrepancies in interpretations between preliminary trainee reports and their final interpretation as "unlikely to be significant" (minor discrepancies) or "likely to be significant" for patient management (major discrepancies). The frequency of minor, major and all discrepancies was compared with 609 emergent non-ECG-synchronised chest CT studies using Pearson's X^2 test.
Results: The total number of discrepancies was significantly higher in the TRO group (11.2%) compared to the control group (6.7%, p=0.008). Minor discrepancies occurred more often in the TRO group (9.1% vs. 3.9%, $p < 0.001$), but there was no difference in the frequency of major discrepancies (2.1% vs. 2.8%, p=0.55). Minor discrepancies in the TRO group most commonly resulted from missed extrathoracic findings with missed liver lesions being the most frequent. Major discrepancies mostly encompassed cardiac and extracardiac vascular findings.
Conclusion: On-call resident interpretation of TRO CT studies in patients with acute chest pain is congruent with final subspecialty attending interpretation in the overwhelming majority of cases. The rate of discrepancies likely to affect patient management in this domain is not different from emergent non-ECG-synchronised chest CT.
Author Disclosures:
U.J. Schoepf: Consultant; Bayer, Bracco, GE, and Siemens.

B-0019 11:42

Assessment of coronary plaque by coronary CT angiography in patients with acute coronary syndrome non-ST segment elevation

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Purpose: To evaluate plaque characteristics of culprit lesion in patients with acute coronary syndrome (ACS) non-ST segment elevation.
Methods and Materials: 25 patients with ACS non-ST segment elevation underwent coronary CT angiography (64-MSCT Aquilion, Toshiba, Japan; 100-120 ml intravenously contrast agent Ultravist 370 ,Bayer, Germany) within 24 hours after onset. The plaques were divided in 4 groups, namely, soft (Group 1), mixed (Group 2), calcified (Group 3), obstructive (Group 4). The level was between 360-380 HU, the window between 1010-1030 HU. We estimated 5 criteria of culprit lesion: X-ray minimum density, length of plaque, spotty calcification (diameter < 3 mm), remodeling index, rough contour, the ring-like enhancement.
Results: We evaluated 25 coronary segments. Soft plaques were in 28% (n=7). Mixed plaques were in 52% (n=13). Calcified plaques were in 8% (n=2). Obstructive plaques (with thrombotic component) were in 12% (n=3). Mean density of plaque in Group 1 was 34.7±10.5 (18-60) HU, in Group 2 was 51.2±24.2 (2-105) HU. Spotty calcification was in 57% (n=4) in Group 1. Rough contour was identified in all plaques. Mean length of plaques was 16.86±6.94 mm. Positive remodeling was in 88% (n=22). Mean remodeling index was 1.28±0.13. The ring-like enhancement was in 24% (n=6).
Conclusion: Coronary CT angiography allows detect unstable plaque, subsequently resulting in ACS.

B-0020 11:51

Right-to-left ventricle ratios on pulmonary CTA in patients with acute pulmonary embolism: correlation of volumetric ratio, embolus burden and adverse outcome

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Purpose: The right-to-left ventricle ratio (RV/LV) is an important predictor of right heart dysfunction in patients with acute pulmonary embolism (APE). We compared the correlation of volumetric RV/LV, embolus burden expressed by Mastora score and adverse outcome (AO) of APE with diametrically and planimetrically determined RV/LV on pulmonary CTA.
Methods and Materials: CTAs of 97 patients (median age, 63.5 years) were analysed. For each patient, Mastora scoring was applied, the RV/LV was determined by semiautomated volumetry (vol), diametry (diam) in axial and 4-chamber views (4CH) and planimetry (plan) in axial and 4CH views. The time for ratio measurements was taken.
Results: Correlation coefficients (CC) for RV/LV_{vol} vs. $RV/LV_{plan4ch}$ were r=0.678 ($P < 0.001$), vs. RV/LV_{plan}: r=0.629 ($P < 0.001$), vs. $RV/LV_{diam4CH}$: r=0.580 ($P < 0.001$) and vs. RV/LV_{diam}: r=0.577 ($P < 0.001$). CCs for Mastora scores and RV/LV_{vol} were r=0.663 ($P < 0.001$), RV/LV_{plan}: r=0.645 ($P < 0.001$), RV/LV_{plan}: r=0.606 ($P < 0.001$), RV/LV_{diam}: r=0.574 ($P < 0.001$) and $RV/LV_{diam4CH}$: r=0.566 ($P < 0.001$). The median time needed for determination of RV/LV_{vol}, $RV/LV_{plan4CH}$, $RV/LV_{diam4CH}$, RV/LV_{plan} and RV/LV_{diam} were 16:48 min, 2:11 min, 1:26 min, 57 sec and 25 sec ($P < 0.05$). ROC analysis for evaluation of AO revealed an AUC for $RV/LV_{plan4CH}$ of 0.731 ($P < 0.003$) and 0.700 ($P < 0.01$) for RV/LV_{plan}. AUC for RV/LV_{vol} was 0.786 ($P < 0.001$).
Conclusion: Determination of the RV/LV by planimetry is fast and better correlates with volumetry and the embolus burden than diametry. It is comparable to volumetry in predicting AO.

10:30 - 12:00 **Room D**

Chest

SS 104

Lung cancer screening and pulmonary nodule evaluation

Moderators:
M. Regier; Hamburg/DE
E.J. Stern; Seattle, WA/US

B-0021 10:30

Tobacco smoking and screen-detected lung cancer: does it matter beyond 30 pack-years?

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Purpose: To investigate whether smoking pack-years among high-risk individuals incrementally improves prediction of screen-detected lung cancer.
Methods and Materials: National Lung Screening Trial (NLST) participants (n=53,452), each with smoking history of ≥30 pack-years were stratified by pack-years into three groups (≥60 and ≤42 identifying high and low; mean±SD=83±23 and 37±4 respectively). For our analytic sample, we randomly selected 6,000 individuals from the high (2,911) and low (3,089) strata. We then estimated the propensity (PS) for high-smoker (exposure) using multivariate logistic regression and 48 covariates, including socio-demographics, occupational exposure, smoking status (former/current), family history, and medical and extra-pulmonary cancer history. An optimal pairwise propensity match produced 1,493 pairs of low- and high-smoker individuals. In the matched sample, we estimated the association between high (vs. low-) smoking and confirmed lung cancer (outcome), adjusting for PS and covariates still imbalanced after matching, then compared these results to a model built for all 6,000 individuals.
Results: High-smokers were older (62 vs. 60 years), and had younger smoking-onset age (16 vs. 18) than low-smokers. In our matched sample, logistic regression estimated an odds ratio (OR) of 2.0 (95% CI:1.2 - 3.3; p=0.008) for confirmed lung cancer, compared to 2.2 (CI:1.6 - 3.1; $p < 0.0001$) in the pre-match sample.
Conclusion: In NLST, lung cancer detection is significantly higher (OR=2.0) in smokers with history of ≥60 pack-years as compared to ≤42 pack-years, even after extensive covariate adjustment. Further analysis might suggest a new threshold for pack-years as a screening selection criterion to reduce false-positives and cost.

B-0022 10:39

Overruling of screen test results in a CT lung cancer screening trial: value of radiologists' expertise

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Purpose: To investigate the impact of radiologists' expertise on test result decisions made in a CT lung cancer screening trial.
Methods and Materials: In the Dutch-Belgian randomised lung cancer screening trial (NELSON), the baseline screen result was based on the lung nodule with largest volume. According to the protocol, nodule volume< 50 mm^3, 50-500 mm^3 and > 500 mm^3 led to a negative, indeterminate and positive screen result, respectively. However, the NELSON protocol allowed radiologists to adjust the screen result. All participants in whom the baseline screen result was based on a solid nodule were included. Baseline nodule volume and screen result according to protocol were compared to the final screen result. Nodules were followed for up to 6.8years.
Results: In 3269 participants (2759 male, median age 58.0 years), the baseline result was based on a solid nodule. In 189 participants (5.8%), the initial result for the nodule was adjusted by the radiologist. Median follow-up time of these nodules was 5.5years. The screen result was adjusted from positive or indeterminate to negative in two and 118 participants, respectively. None of these nodules turned out malignant. The result was adjusted from negative or positive to indeterminate in one and 64 participants, respectively. Lung cancer was detected in two (3.1%) nodules with volume> 500 mm^3 four years later. In four participants the screen result was adjusted from indeterminate to positive; two nodules were malignant (50%).
Conclusion: In a baseline lung cancer screening study, the readers adjusted the screen result in 5.8%. Radiologists' expertise can reduce false-positive and false-negative screen results.

B-0023 10:48

Comparison of diameter and volume measurements for the estimation of nodule size for lung nodules detected in a CT lung cancer screening trial

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Purpose: To compare congruity of estimation of lung nodule size in a lung cancer screening trial by calculating volume based on maximal and mean transversal diameter measurements, and measurements from semi-automated volumetric software.
Methods and Materials: The diameter and volume measurements of 7,914 solid pulmonary nodules detected in 3,165 participants from the Dutch-Belgian randomised lung cancer screening trial (Dutch acronym: NELSON) were evaluated. CT-scans were performed in low-dose setting. Nodule volumes were obtained semi-automatically in the LungCARE software, and were compared to volumes based on the maximal transverse diameter (*D*) and the mean transversal diameter in x-y direction, without taking into account the diameter standard deviation, and assuming a spherical shape of the nodule (formula: *Volume*=(1/6)*pi*D^3).
Results: Semi-automated software yielded a median nodule volume of 37.5 mm^3 (Interquartile Range (IQR): 23.8-67.7 mm^3). The median estimated nodule volume using maximal and mean transversal diameter, was 61.6 mm^3 (IQR: 38.8-130.9 mm^3), and 47.7 mm^3 (IQR: 28.7-91.9 mm^3), respectively. The use of maximal diameter and mean diameter to estimate nodule size overestimated nodule volume by 55.6% (median, IQR: 25.3-96.1%) and 23.8% (median, IQR: 1.6-51.5%), respectively, compared to semi-automated volumetry. This overestimation would result in an increase of positive test results in a lung cancer screening setting based on diameter measurements.
Conclusion: Estimation of nodule volume based on maximal transversal diameter measurements overestimates nodule size compared to semi-automated volumetry. We recommend using nodule volume instead of diameter to assess lung cancer probability and determine thresholds for screening results.

B-0024 10:57

Ground glass nodules: CT-epidemiological analysis of growth patterns

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Purpose: To quantify growth patterns of solitary pure ground glass nodules and to relate these pattern to epidemiological factors.
Methods and Materials: Between 2008 and 2011, 95 patients were diagnosed on CT with solitary pure ground glass nodule (pGGN) at our hospital. CT features of pGGNs were evaluated at an initial and a follow-up CT. pGGNs were divided into "persisting" or "resolved". Persisting nodules were further classified according to potential changes in total or solid component diameter into "decreased", "unchanged", and "increased". Clinical and demographic data were recorded. Association of data with morphological pGGNs characteristics were tested with Kruskall-Wallis test and logistic regression.
Results: After a median follow-up of 16 months, 19/95 (20%) pGGNs resolved and 76/95 (80%) persisted. Of the persisting pGGNs, 51/76 (67.1%) were unchanged, 18/76 (23.7%) increased in size, and 7/76 (9.2%) decreased. Growth was more likely with age ≥ 67 years and a diameter ≥ 10 mm (OR 4.636; p = 0.016). No significant relation was found between pGGNs growth and gender, history of cancer, or pGGN location. pGGN resolution was more likely with age < 67 (OR 3.28; p = 0.04). No difference in diameter was found between resolved and persisting pGGNs (p = 0.21).
Conclusion: As expected, persisting larger pGGNs were more likely to grow than small pGGNs. However, solitary pGGNs were more likely to grow in older than in younger patients. This observation could help to tailor future follow-up recommendations for pGGNs with regard to the seemingly paradoxical influence of patient age.

B-0025 11:06

Evaluation of subcentimeter ground-glass nodule at very low dose CT: impact of different levels of iterative reconstruction

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Purpose: The purpose of our study was to determine the effect of different levels of iterative reconstruction on the evaluation of ground-glass nodule at significantly reduced radiation doses.
Methods and Materials: An anthropomorphic chest phantom containing a sub-centimeter ground glass lung nodule was scanned at 80, 100 and 120 kV with 10, 20, 40, 75 and 110 mA. Images were reconstructed with filtered back projection (FBP) and sinogram-affirmed iterative reconstruction (SAFIRE) algorithm using two different strengths of iterative reconstruction (3 and 5). Forty-five image sets were randomised and shown to two chest radiologists independently. For each image, both radiologists measured the largest lesion diameter and evaluated lesion conspicuity on a five-point scale. A score of 3 was considered acceptable for lesion conspicuity. Data was analysed with paired *t*-test, Friedman test and Wilcoxon signed rank test. Kappa statistics were used for inter-reader agreement.
Results: The lowest radiation dose parameters with an acceptable score were 80 kVp/10 mAs (0.098mSv) for IR-5 and 100 kVp/10 mAs (0.224 mSv) for FBP and IR-3. Mean lesion diameter was comparable between FBP, IR-3 and IR-5 for effective doses above and below 1 mSv ($p > 0.05$). The diameter measurements were similar for both radiologists below 1 mSv for each reconstruction algorithm ($p > 0.05$). Inter-reader agreement for subjective assessment of lesion conspicuity was fair (k=0.259). Image noise, CNR and SNR were significantly different between the three reconstruction algorithms ($p < 0.001$).
Conclusion: Increasing the strength of iterative reconstruction may allow greater dose reduction without compromising size and conspicuity of ground glass nodule.
Author Disclosures:
K. Parekh: Research/Grant Support; Educational Grant Support from Siemens Healthcare. **A.R. Seyal:** Research/Grant Support; Educational Grant Support from Siemens Healthcare.

B-0026 11:15

Usefulness of alpha blending of maximum intensity projections or ray sums with segmented pulmonary nodules and vasculature for the evaluation of small nodules or ground glass opacity lesions

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Purpose: There are many small lung nodules and ground glass opacity (GGO) lesions depicted on computed tomography (CT) scans that are difficult to diagnose using chest computed radiography (CR) or a cine display of serial chest radiographs obtained with a flat-panel detector (FPD-SR). Alpha blending was used to display an alpha bitmap, which is a bitmap that has transparent or semi-transparent pixels. We aimed to use the alpha-blended images obtained from CT to support the diagnosis of pulmonary nodules.
Methods and Materials: Using alpha blending, thick slab, coronal maximum intensity projection (MIP), or ray sum images were overlaid with the segmented pulmonary nodule and vasculature using various transparencies. In the comparison of the detectability of pulmonary nodules on FPD-SR and chest CR, 18 patients with 20 nodules were included that were confirmed by CT and were difficult to diagnose with FPD-SR and CR. For each patient, FPD-SR, CR, and CT with and without alpha-blended images were evaluated independently by four radiologists for a subjective image assessment of the diagnostic quality.
Results: Alpha-blended images preserved the depth relationship between the nodule and the rib or pulmonary vasculature and prevented these small structures from being obscured. Subjective image analysis illustrated a significant improvement when employing alpha blending for clinically relevant criteria such as diagnostic confidence.
Conclusion: Alpha blending of thick slab MIP or ray sum images with segmented pulmonary nodules and vasculature provides useful information concerning the exact localisation of small lung nodules, including GGO, on FPD-SR and CR.
Author Disclosures:
Y. Nakano: Grant Recipient; Canon Inc.

B-0027 11:24

Pulmonary adenocarcinoma presenting as part-solid ground glass nodule: is measuring solid component only appropriate in current staging system?

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Purpose: To find out appropriate measurement for pulmonary adenocarcinoma presenting with part-solid ground glass nodule (psGGN), by comparing disease-free survival (DFS) and overall survival (OS) with adenocarcinoma appearing as solid nodule (SN).
Methods and Materials: Our study included 501 patients (304 SN and 197 psGGN) who underwent curative surgery for pathologic stage I adenocarcinoma between 2002 and 2011. Maximal diameters of lesions were measured on axial preoperative CT images. For psGGN, maximal diameters of whole lesions and solid components were separately measured on axial thin slice (≤2 mm) images. DFS and OS were calculated from the date of surgery. To find out significant factor for DFS and OS, Cox proportional hazard analyses were performed. Afterwards, interaction term between solid component size and nodule type was inserted to compare prognoses of SN and psGGN with same size of solid component.
Results: The size of solid component was the only significant factor for DFS and OS in multivariate Cox analyses in psGGN group only (Hazard ratios 4.68 and 3.46 for DFS and OS, respectively, for 1 cm increase in size) and in whole patients group (Hazard ratios 1.81 and 1.73 for DFS and OS, respectively). Comparing prognoses of psGGN and SN based on Cox-regression model with

interaction term, psGGN showed better DFS and OS when solid components were ≤2 cm, but SN showed better prognoses when solid components were larger.
Conclusion: Measuring solid component only might be an appropriate method to evaluate adenocarcinoma presenting as psGGN. However, psGGN and SN showed different prognoses in same size of solid component

B-0028 11:33

Differentiation of invasive pulmonary adenocarcinomas presenting as pure ground-glass nodules from their preinvasive lesions by using computerised image feature analysis from multi-detector computerised tomography images

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Purpose: To evaluate the diagnostic feasibility of three-dimensional computerised image feature analysis of multi-detector computerised tomography (MDCT) images to aid differentiation of invasive pulmonary adenocarcinomas (IPAs) presenting as a pure ground-glass nodules (PGGNs) from their preinvasive lesions.
Methods and Materials: This retrospective study was finally included a total of 38 patients with 40 pulmonary nodules presenting as PGGN on thin-section (≤1 mm section thickness) MDCT without contrast enhancement from January 2005 to February 2013. All of these nodules were pathologically confirmed and divided into IPA group (n=9) and preinvasive group including atypical adenomatous hyperplasia (n=13) and adenocarcinoma in situ (n=18). Manual segmentation was performed in each PGGN on every slice of CT images and computerised image features were quantitatively extracted using in-house developed software. To identifying image features between IPAs and their preinvasive lesions, independent t-test and multivariate logistic regression analysis were performed.
Results: Between IPA group and preinvasive lesion group, patient's age (60.3 vs. 57.2years, respectively, P=.340) and lesion size (14.6 vs. 11.3 mm, respectively, P=.441) were not significantly different. By independent t-test of image features revealed that mean attenuation number (P=.043), standard deviation of attenuation number (P=.016), 95percentile of attenuation number (P=.008), entropy (P=.008) and gray-scale co-occurrence matrix contrast (P=.036) were significantly different between IPA and preinvasive lesion. However, multivariate logistic regression analysis including those image features revealed that entropy was the only differentiating variable (P=.020). Sensitivity and specificity were 22.2% (2/9) and 90.3% (28/31), respectively.
Conclusion: We suggest that entropy are specific image feature and may be helpful in differentiating IPAs presenting as PGGN from preinvasive lesion.

B-0029 11:42

Dynamic first-pass pulmonary perfusion area-detector CT for lung nodule assessment: comparison of dose reduction capability between adaptive iterative dose reduction using 3D processing and filter back projection

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Purpose: To directly compare the capability for radiation dose reduction on dynamic chest perfusion area-detector CT (ADCT) aiming lung and nodule perfusion assessments between adaptive iterative dose reduction using 3D processing (AIDR 3D) and filter back projection (FBP) methods.
Methods and Materials: 36 consecutive patients with pulmonary nodules underwent standard-dose perfusion ADCT (SDCT) using the following parameters: 320×0.5 mm collimation, 80 kVp, 120 mA, and 0.5 sec gantry rotation time. From SDCT raw data, low-dose perfusion ADCTs (LDCTs) at 80 mA, 60 mA and 40 mA were computationally simulated. Then, SDCT and each LDCT were reconstructed by AIDR 3D and FBP methods. From each CT data, perfusion map was computationally generated. Then, image noises of lung parenchyma and nodule, lung and nodule perfusions were evaluated by ROI measurements. To determine the utility of AIDR 3D for radiation dose reduction, both image noises and perfusion parameters from all CT data were statistically compared each other by using Tukey's HSD test. Correlations and the limits of agreement on both perfusion parameters at each LDCT were statistically evaluated.
Results: When applied AIDR 3D, image noises of LDCT at 80 mA and 60 mA were significantly lower than those by FBP ($p < 0.05$). Lung and nodule perfusions had significant and excellent correlations between SDCT and each LDCT ($p < 0.001$). The limits of agreement on each LDCT applied AIDR 3D were smaller than that applied FBP.
Conclusion: AIDR 3D method has better potential for radiation dose reduction of chest perfusion ADCT than FBP method in routine clinical practice.

Author Disclosures:
Y. Ohno: Research/Grant Support; Toshiba Medical Systems Corporation, Daiichi-Sankyo, Co. Ltd., Bayer Pharma. **S. Seki:** None. **M. Nishio:** Research/Grant Support; Toshiba Medical SystemsCorporation. **H. Koyama:** None. **T. Yoshikawa:** Research/Grant Support; Toshiba Medical Systems Corporation.s. **Matsumoto:** Research/Grant Support; Toshiba Medical Systems Corporation. **Y. Fujisawa:** Employee; Toshiba Medical Systems Corporation. **N. Sugihara:** Employee; Toshiba Medical Systems Corporation. **K. Sugimura:** Research/Grant Support; Daiichi-Sankyo Co. Ltd., Bayer Pharma.

B-0030 11:51

Prognostic value of spirometry and pulmonary CT biomarkers for cardiovascular events in a lung cancer screening setting

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Purpose: To assess the prognostic value of spirometry and quantitative pulmonary CT biomarkers for cardiovascular events.
Methods and Materials: 3057 male lung cancer screening subject who underwent spirometry and non-gated chest CT were analysed. Forced expiratory volume in one second percent predicted (FEV1%predicted) and FEV1 divided by forced vital capacity (FVC) were obtained. Coronary artery calcium volume, pulmonary emphysema (Perc15) and bronchial wall thickness (Pi10) were measured on the CT scans. The primary combined endpoint included fatal and non-fatal cardiovascular events. The ability of spirometry and pulmonary CT measures to predict events was evaluated by Cox proportional hazards analysis. Next, net reclassification improvement (NRI) and incremental C-indices were calculated.
Results: Median follow-up was 2.9 (25p-75p 2.7-3.3) years and during that period 183 participants developed a cardiovascular event. Spirometry and pulmonary CT biomarkers were associated with an increased risk of cardiovascular events. Age, smoking status and pack-years adjusted hazard ratios were 0.992 (95%-CI 0.985-0.999) for FEV1%predicted, 1.001 (95%-CI 0.987-1.015) for FEV1/FVC 1.014 (95%-CI 1.004-1.023) for perc15 per 10 HU and 1.264 (95%-CI 1.019-1.567) for pi10 per 1 mm. Incremental C-index (< 0.012) and NRI (0.22). In contrast, coronary artery calcium volume had an adjusted hazard ratio of 1.046 (95%-CI 1.034-1.058) per 100 mm3, a significant increase in C-index of 0.077 and an impressive NRI of 17.3% ($P < 0.0001$).
Conclusion: Spirometry and pulmonary CT biomarkers were significantly associated with cardiovascular events, but did not provide relevant independent prognostic information for cardiovascular events in a male lung cancer screening population.
Author Disclosures:
H.J. de Koning: Advisory Board; Roche Diagnostics. **T. Leiner:** Research/Grant Support; Bracco Diagnostics. Speaker; Philips Healthcare, Bayer Healthcare.

10:30 - 12:00 **Board Room B**

Emergency Radiology

SS 117

Impact of radiology on emergency services

Moderators:
D. Nunez; New Haven, CT/US
F. Schwarz; Munich/DE

B-0031 10:30

How does arm positioning of polytraumatised patients in the initial CT affect image quality and diagnostic accuracy?

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Purpose: To evaluate the influence of different arm positions on abdominal image quality during initial whole-body CT (WBCT) in polytraumatised patients and to assess the risk of missing potentially life-threatening injuries due to arm artefacts.
Methods and Materials: Between July 2011 and February 2013, WBCT scans of 203 patients with arms in the abdominal area during initial WBCT were analysed. Six different arms-down positions were defined. 203 patients with elevated arms beside the head served as a control group. Two observers jointly evaluated image quality of different organ regions using a 4-point-scale system. Follow-up CT-examinations were analysed to identify findings missed during initial WBCT due to reduced image quality.

Results: Image quality was most severely degraded in patients with arms down alongside the torso, followed by patients with arms crossed in front of the pelvic area and patients with arms crossed in front of the upper abdomen, respectively. Positioning with one arm up resulted in significantly better image quality than both arms down ($p < 0.01$). Overall, arms-up positioning showed significantly better image quality than arms-down positions ($p < 0.01$). In one case, liver haemorrhage missed in the initial WBCT because of arm artefacts, was revealed by follow-up CT.
Conclusion: In WBCT arms-down positioning significantly degrades abdominal image quality and artefacts might even conceal potentially life-threatening injuries. If the patient's status does not allow elevation of both arms, image quality can benefit from raising at least one arm. Otherwise, arms should be placed in front of the upper abdomen instead of alongside the torso.

B-0032 10:39

Indication of whole-body multislice computed tomography in polytraumatised children

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Purpose: To retrospectively analyse the applicability of a triage protocol for the indication of whole-body MSCT as well as epidemiologic data from children with suspected polytrauma.
Methods and Materials: 72 children (49 male, aged 1 to 14 years) admitted to a Level 1 trauma center with suspected polytrauma during 2004 to 2009 were enrolled. Whole-body MSCT (16-slice SIEMENS Somatom Sensation CT; sliding gantry) was indicated as in adult patients if one triage criteria basing on mechanism of injury, vital parameter and injury pattern was fulfilled. Data analysis included under- and overtriage rates, Injury Severitiy Score (ISS), mechanism of injury, injury pattern, delayed diagnosis, lethality. ISS≥16 defined polytrauma.
Results: The undertriage rate (ISS≥16, no whole-body MSCT) was 26.3% (n=19), the overtriage rate (ISS< 16, whole-body MSCT) was 20.8% (n=15). All patients subject to undertriage underwent region specific MSCT. The mean ISS was 26.5 (range 2-75). Typical mechanisms of injuries were motor vehicle accidents (59.7%) and falls from height (33.3%). Injuries to the head and face were most common (52.8% and 25.0%), followed by extremitiy (51.4%), thoracic (36.1%) and abdominal (19.4%) injuries. Delayed diagnosis occurred in 3 cases. Lethality was 8.3%; in 4 of 6 patients trauma-related death was caused by injuries to the head.
Conclusion: An adult triage rule for the indication of whole-body MSCT in children does not seem to be applicable due to high under- and overtriage rates. Knowledge of epidemiologic data can help to improve radiological trauma algorithm in the multiple injured child emphasising modalities with low radiation exposure.

B-0033 10:48

Feasibility of a dual-room sliding gantry CT concept for initial evaluation of trauma patients

C. Frellesen, M. Böttcher, J. Kerl, J.L. Wichmann, T.J. Vogl, R.W. Bauer;
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Purpose: To evaluate the time-saving potential of a dual-room sliding gantry CT system in comparison with a routine single-room CT for initial assessment of patients in the trauma room.
Methods and Materials: We compared the mean amount of time between initial admittance of the patient to the trauma room, start of the CT scan and end of initial trauma evaluation. 30 patients each were evaluated using a traditional single-room CT and a novel dual-room sliding gantry CT. Statistical analysis was performed using the Wilcoxon-Mann-Whitney-test and Fisher's exact test.
Results: Patient groups were comparable as to sex, age and Injury Severity Score ($p > 0.66$). Median time from patient arrival to start of the diagnostic CT was significantly shorter with sliding gantry CT (15.4 min vs. 21.2 min, $p < 0.001$). Median time between trauma room admission and discharge was also significantly shorter with the dual-room concept (41.3 min vs. 62.1 min, $p < 0.001$).
Conclusion: The dual-room sliding gantry CT concept allows for significant time savings in the initial evaluation of trauma patients. Furthermore, it reduces necessary patient transfer and manipulation of bearing devices.

B-0034 10:57

CT and MR track reconstruction of experimentally produced stab wounds

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Purpose: To measure by computed tomography (CT) and magnetic resonance (MR) the length of stab wounds (SWs) experimentally produced on human calves. Only a few data on the CT features of SWs are available in the clinical and forensic literature and, to the best of our knowledge, MR data are still missing.
Methods and Materials: Ten SWs were inflicted on human legs surgically amputated for medical reasons using a ceramic knife perpendicularly oriented to the skin (depth of SWs varying between 3.0 and 6.0 cm). CT and MR scans were performed before stabbing; with the knife inside the wound track (only CT scans); and before/after filling each wound with the contrast medium (1:10 dilution of Omnipaque 300 GE Healthcare® with ultrasound gel). The depth of the wound tracks was measured by an experienced radiologist (blind to the experimental conditions) using Osirix (Open Source) software.
Results: CT and MR measurements underestimated the depth of SWs injuries with a mean error of 6.9% (range: -33.5%-17.4%) and 6.7%, respectively (range: -20.9%-14.4%). There was no statistical difference between CT and MR measurements.
Conclusion: Our preliminary results show that CT and MR investigations of SWs filled up with contrast medium provide consistent and reproducible data on the depth of the inflicted injury. Further efforts will be made to improve the injection modality of the contrast medium, in order to minimise underestimation errors.

B-0035 11:06

Image quality of iterative reconstruction in cranial CT imaging: comparison of model-based iterative reconstruction and adaptive statistical iterative reconstruction

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Purpose: CCT is a frequent examination in emergency departments. Model-based iterative reconstruction (MBIR) is the successor of adaptive statistical iterative reconstruction (ASIR), promising a more effective reduction of image noise and improved spatial resolution. In this study, we compare the effects of MBIR and ASIR in CCT.
Methods and Materials: 100 trauma patients received CCT according to the institutional standard protocol (120 kV, 260 mAs, 20 mm detector collimation, 0.984 pitch). Raw data sets and multiplanar reformations (MPRs) of 2.5 mm were reconstructed with ASIR and MBIR. Two radiologists blinded to the reconstruction algorithm evaluated the depiction of anatomical structures and amount of artefacts using a semi-quantitative scale (0:non-diagnostic, 1 impaired, 2:sufficient; 3:good, 4:excellent). Data were analysed with Mann-Whitney U test and ANOVA. Mean attenuation values (MAV) and standard deviation (SD) were measured for white matter (WM) and liquor space (LS).
Results: MBIR significantly reduced streak artefacts better than ASIR. IQ of MBIR were rated significantly superior than ASIR images with median scores of 3 and 2, respectively. SD of WM especially in the posterior fossa was significantly lower in MBIR MPRs (4.86 ± 1.95; 4.79 ± 2.34) in comparison to ASIR (5.53 ± 2.15; 5.91 ± 2.93); ($p < 0.05$). MAVs of WM were significantly higher in ASIR than in MBIR.
Conclusion: Our results suggest significant improvement of IQ with MBIR compared to ASIR in CCT of trauma patients. MBIR being a more accurate reconstruction algorithm could represent an effective method to decrease the radiation dose of CCT.

B-0036 11:15

Detection of blunt biliary injuries using hepatocyte-specific contrast-enhanced MR cholangiography

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Purpose: We are to investigate the hepatocyte-specific contrast-enhanced magnetic resonance cholangiography (HEMRC) for the detection of blunt biliary injuries.
Methods and Materials: From May 2012 to September 2013, twelve patients of major blunt liver trauma consented to be enrolled in this study. The HEMRC was acquired at 10, 20, 30 and 90 minutes respectively after intravenous injection of hepatocyte-specific contrast medium (Gd-EOB-DTPA). We compared the diagnostic performance of HEMRC of different acquisition times for the detection of biliary injuries. Medical charts were reviewed for course of treatments and final diagnosis.
Results: MRI of all patients showed traumatic cysts in the injured liver. Among them, HEMRC of nine patients detected biliary injuries evidenced by extravasation of biliary contrast medium. Biliary extravasation was first detected at 10 minutes (n=1), 20 minutes (n=3), 30 minutes (n=2), 90 minutes (n=3). All were best visualised on HEMRC acquired at 90 minutes. Of the traumatic cysts in three patients without biliary extravasation, two were hematomas, one was abscess. Of the nine patients with biliary injuries, four received catheter drainage, five were treated with observation. All had clinical improvement and were discharged.
Conclusion: Blunt biliary injuries can be detected on HEMRC. The extravasated biliary contrast medium is best seen at a delayed hepatobiliary phase acquired at 90 minutes after intravenous injection of hepatocyte-specific contrast medium (Gd-EOB-DTPA).

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B-0037 11:24

Clinical impact of chest and abdominal CT on emergency patients
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Purpose: To evaluate the impact of computed tomography (CT) examinations in determining a management change of patients admitted to the emergency department (ED), quantifying therapeutic variation determined by CT scans.
Methods and Materials: We prospectively analysed thoracic/abdominal CT examination requests from our ED, from October 2012 to March 2013. Before each CT, we asked the ED physicians to provide the most-likely diagnosis (12 choices were offered, including a wide range of ED diseases) and the most appropriate foreseen management without CT scan information (admit to hospital, keep in observation, patient discharge). Once CT was performed, ED physicians were asked to evaluate the concordance between therapeutic management before and after CT, by evaluating CT report as following: not reliable, not confirming clinical diagnosis (level 1), confirming clinical diagnosis without (level 2) or with (level 3) new information, change of diagnosis (level 4). Furthermore, we defined as a major change the sum of level 1 and 4, and as a minor change the sum of level 0, 2 and 3.
Results: We analysed 300 CT scans in 300 patients. CT examination was able to change the planned treatment in 202 cases (67%) and to confirm it in 98 cases (33%). Concerning score level on patients' management, a major change in planned treatment was obtained in 112 cases (56%) and a minor change in 90 cases (44%).
Conclusion: CT examination in ED patients permitted a planned treatment change in 67% of cases and in 56% of cases determined a major variation. CT represents a predictor for hospital ED admission or discharge.

B-0038 11:33

Whole-body CT-based imaging algorithm for multiple trauma patients: radiation dose and time to diagnosis
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Purpose: To determine the number of radiological investigations, associated radiation dose, and time to diagnosis in multiple trauma patients before and after introduction of whole-body CT (WBCT) as primary diagnostic tool in early trauma care.
Methods and Materials: 120 consecutive patients assessed before the introduction and 120 consecutive patients assessed after the introduction of WBCT into our hospitals' trauma algorithm were compared regarding number and types of CT, X-ray and FAST examinations, radiation dose, and time to primary trauma-related diagnosis.
Results: In the WBCT cohort the number of CT studies of the head, cervical spine, chest and abdomen was significantly ($P < .001$) higher as compared to the non-WBCT cohort. In contrast, the number of X-ray examinations of the cervical spine, chest and pelvis and the number of FAST was significantly ($P < .001$) higher in the non-WBCT cohort. There were no significant ($P = .56$ and $P = .30$) differences between cohorts regarding the number of X-rays of upper and lower extremities. We found significantly ($P < .001$) higher effective doses in the WBCT as compared to the non-WBCT cohort but also significantly (on average 29.5mSv vs 15.9mSv per patient, $P < .001$), but less additional imaging studies were needed in the WBCT cohort ($P < .001$). Additionally, the time to primary trauma-related diagnosis was significantly shorter in the WBCT cohort (on average 0.19h vs 1.24h per patient, $P < .001$).
Conclusion: After introduction of WBCT into our trauma algorithm, overall radiation doses were higher in patients, but less additional imaging studies were needed and the time to obtain the primary trauma-related diagnosis was shorter.

B-0039 11:42

Risk factors for non-compliance with recommendations by emergency radiologists
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Purpose: To identify risk factors associated with non-compliance of recommendations made by emergency radiologists.
Methods and Materials: Between March 2012-August 2012, we reviewed 20000 consecutive emergency department patients receiving imaging at two university hospitals to assess how often emergency radiologists made recommendations, how often they were followed and what factors were associated with non-compliance. The data was extracted from medical records and the hospital information system: recommendation in imaging report, age, sex, race, insurance status, primary care contact, distance from the hospital to patient residence, and primary language. Recommendations were categorised: 1_immediate follow-up; 2_follow-up 1-4 weeks; 3_follow-up 1-3 months; 4_follow-up 4-6 months; 5_follow-up 7-12 months and 6_clinical correlation.
Results: We identified 1650 recommendations (1650/20000=8.25%). Using a one to one logistic regression analysis, the following factors were significant ($p < 0.05$) when evaluating non-compliance: increasing age, no primary care physician, lack of insurance, increased distance from hospital and extended follow-up interval. Primary language was not a significant factor in non-compliance.
Conclusion: Emergency radiologists rarely make recommendations. Immediate and short-term interval follow-up recommendations are more likely to be followed. Decreased compliance is associated with extended interval follow-up recommendations. The risk factors for non-compliance are multifactorial and include age, primary care physician status, insurance and distance. Primary and/or referring physicians should take notice of these compliance trends and mitigating factors; adopt systematic safety measures to ensure compliance to counsel and educate patients about the importance of imaging recommendations.

B-0040 11:51

Can CT oesophagography reliably diagnose penetrating oesophageal injury in the trauma population? Preliminary data
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Purpose: To measure the sensitivity and specificity of CT oesophagography (CTE) in diagnosing penetrating oesophageal injury. To determine the diagnostic confidence of the radiologist in detecting these injuries with the use of CTE only. Finally, to determine if CTE can be used as the only imaging examination in penetrating neck trauma to exclude oesophageal injury.
Methods and Materials: Prospective, cross-sectional analytical study was done at Pelonomi Tertiary Hospital in Bloemfontein, South Africa, between December 2012 and November 2013. All adult trauma patients with suspected penetrating oesophageal injuries, who required emergency CTA, were considered for the study. An oral contrast solution was administered before the CTA study. All CT findings were confirmed by other imaging methods. Images were evaluated separately by two independent general departmental radiologists.
Results: Sixty (60) patients qualified for the study. Fifty-four (90%) were male. Knife wounds were the mechanism of injury in 83% of patients. Fourteen (14) confirmed injuries (8 oesophageal and 6 in the hypopharynx) were all detected by CTE. One hypopharyngeal injury diagnosed intra-operatively was missed by CT and fluoroscopic esophagography (CTE sensitivity of 93%). CTE specificity was 82% (8 false positives) and 91% (4 false positives) respectively. The two radiologists were positive to very confident of their findings in 80 and 88% of cases respectively.
Conclusion: Good sensitivity and specificity were achieved by both radiologists using CTE. Preliminary data suggests that CTE is reliable in detecting penetrating oesophageal injuries and that general radiologists will be confident in using this examination.

10:30 - 12:00 **Room E1**

Musculoskeletal

SS 110

Shoulder and wrist

Moderators:
S. Morozov; Moscow/RU
M. Reijnierse; Leiden/NL

B-0041 10:30

The Mick Jagger position: a new manoeuvre for the intra-articular biceps ultrasound visualisation
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Purpose: To demonstrate the feasibility of a new dynamic ultrasound manoeuvre, consisting in abduction and external rotation, for the visualisation of the intra-articular course of the long biceps tendon above the humeral head to its insertion on the glenoid.
Methods and Materials: A cadaveric study was performed to demonstrate the course of the tendon, as well as the presence of an acoustic window between the acromion and the coracoid process during the manoeuvre. A prospective study was performed on 40 asymptomatic subjects of various age, as well as 10 patients referred for shoulder pain, in whom a correlation to MRI was also

obtained. Two observers graded the presence of an acoustic window, as well as the visibility of the biceps tendon on a scale from 1 to 4.
Results: The visibility of the biceps tendon was diagnostic in 83% (n=36) 33 of the 40 asymptomatic subjects. In the 10 pathologic shoulders, the biceps tendon was visible in its intra-articular course in all patients. Ultrasound demonstrated 4 cases of tendinosis (tendon hypertrophy and/or loss of fibrillar pattern) and 1 synovitis surrounding the intra-articular biceps tendon, in correlation with MRI.
Conclusion: The manoeuvre in abduction external rotation allows the evaluation of the biceps tendon in its intra-articular course to its insertion on the glenoid in up to 83% of subjects.

B-0042 10:39

A new dynamic manoeuvre to differentiate complete vs. partial distal bicep tears at ultrasound

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Purpose: To demonstrate the feasibility and to assess the diagnostic value of a dynamic ultrasound manoeuvre for the diagnosis of complete vs. partial tears of the distal biceps tendon at the elbow.
Methods and Materials: A cadaveric study on four specimens was performed to demonstrate the movements of the distal biceps tendon during passive prono-supination of the forearm, before and after the creation of partial (50%) and complete (100%) tears of the tendon, with integrity of the lacertus fibrosus. 15 patients, including 4 patients with a complete tendon tear, 1 patient with a partial tendon tear and 10 normal tendons were studied independently by two observers. Before the examination following a conventional technique, the dynamic passive prono-supination manoeuvre was performed while the tendon was examined in the transverse plane by the observers, blinded to the final diagnosis.
Results: The cadaveric study showed that the manoeuvre lead to an anteroposterior movement of the distal biceps tendon in normal and partially torn tendons, but not in completely torn tendons. The manoeuvre allowed accurate diagnosis of complete vs. partial tendon tears in 100% of cases, with surgery as a reference.
Conclusion: A manoeuvre of passive prono-supination of the forearm is useful for the ultrasound diagnosis of complete vs. partial tears of the distal biceps tendon.

B-0043 10:48

Ultrasound-guided block of suprascapular nerve as a treatment of adhesive capsulitis: indications, technique and early results

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Purpose: Adhesive capsulitis (AC) is characterised by pain and stiffness in external rotation and abduction of the upper limb; physiatric rehabilitation (PR) is often difficult.The suprascapular nerve (SN) supplies 70% of shoulder sensitive innervation. US visualises the SN at the level of the spine of the scapula.The purpose of this work is to show that SN block makes a more lasting pain decrease than the intra-articular treatment of capsulitis and makes the PR easier.
Methods and Materials: 20 patients with clinical diagnosis of adhesive capsulitis were randomised in 2 groups (A=10 F, y=45±3.2; B=10 F, y=44±3.6). Group A was treated with US-guided intra-articular injection of 5 cc of hydrocloride mepivacaine 2%, 40 mg of methylprednisolone and 6 ml (90 mg) of hyaluronate. In group B, the US-guided perineural (at the level of the spine of the scapula) injection of 5 cc of hydrocloride mepivacaine 2% was added to the treatment. All patients began PR the day of treatment. All patients underwent clinical (VAS scale and ROM index) both before than immediately after the treatment, at 1 week and 1 month.
Results: VAS before: 8.9 (A), 9.1 (B); immediately after: 5.0 (A), 4.8 (B); at 1 week: 6.2 (A), 4.5 (B); at 1 month: 6.1 (A), 4.0 (B) ($p < 0.01$). ROM before: 100°(A), 95°(B); immediately after: 120°(A, B); at 1 week: 130°(A), 150°(B); at 1 month: 135°(A), 170°(B). We had not complications, in particular no deficit of motion. In all patients of group B, we visualised the SN by ultrasound.
Conclusion: The role of physiatry in rehabilitation and reduction of pain is fundamental.The SN block associated with intra-articular treatment allows an improvement of PR.The SN block has a more lasting effect than intra-articular treatment.

B-0044 10:57

Capsular laxity in atraumatic multidirectional instability of the shoulder: value of MR arthrography including abduction and external rotation images

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Purpose: To evaluate diagnostic signs and measurements for capsular laxity on MR arthrography (MR-A) of the shoulder including abduction/external rotation (ABER) images in patients with atraumatic multidirectional instability (MDI).
Methods and Materials: Twenty-one MR-A including ABER position of 21 patients (mean age: 27 years; 4 males, 16 females) with clinically diagnosed MDI and 17 patients (mean age: 31 years; 12 males, 5 females) without instability were retrospectively assessed by three radiologists. On ABER position MR-A, the presence of a layer of contrast between the humeral head (HH) and the anteroinferior glenohumeral ligament (AIGHL) (crescent sign) and a triangular-shaped space between HH, AIGHL and glenoid (triangle sign) were evaluated; centering of the HH was measured. On standard imaging planes anterosuperior herniation of the rotator interval (RI) capsule and glenoid version were determined.
Results: The crescent sign showed a sensitivity of 57%/62%/48% (observers 1/2/3) and a specificity of 100%/100%/94% in the diagnosis of MDI. For the triangle sign, sensitivity was 48%/57%/48%, specificity was 94%/94%94%. Presence of either sign showed high sensitivity (86%/90%/81%) and specificity (94%/94%/94%). A positive triangle sign was significantly associated with decentering of the HH ($\rho < 0.000$). Measurements of RI herniation, RI width, and glenoid version were not significantly different between both groups.
Conclusion: Combined assessment of laxity signs on ABER position MR-A is accurate in the diagnosis of capsular laxity in patients with atraumatic MDI, whereas measurements on standard imaging planes appear inappropriate.

B-0045 11:06

Diagnostic value of arthro-MRI in the long head of biceps tendon instability due to biceps pulley lesion of the shoulder

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Purpose: To evaluate the added value of the internal and external rotation during arthro-MRI in identifying the LHBT instability and the possible development of an antero-superior impingment (ASI).
Methods and Materials: We retrospectively analysed MRI exam of 70 patients who underwent arthro-MRI (1.5 T) and arthroscopy within the following 7-45 days. Patients had clinical suspicion of biceps pulley lesions. The shoulder was studied (with dedicated coil) in neutral position, in internal and external rotation and ABER in 12 patients.
Results: Patients were divided in 4 groups (Habermayer classification) and evaluated for an unstable LHBT:10 patients had superior gleno-humeral ligament (SGHL) tear (Type I),16 patients SGHL and supraspinatus (SSP) tendon tears (Type II),21 patients SGHL and subscapularis (SSC) tendon tears (Type III) and 23 patients SGHL, SSP and SSC tears (Type IV). At arthroscopy 2 patients were negative,8 patients had Type I,16 patients Type II,19 patients Type III and 25 patients Type IV lesions. MRI internal and external rotation showed an initial anteromedial subluxation of the LHBT in 8 patients with Type II lesion and an anteromedial subluxation of the LHBT in all patients with Type III and Type IV lesions.The dynamic tests during arthroscopy, confirmed LHBT instability and ASI features in patients with Type III and Type IV lesions.
Conclusion: Only high grade lesions of biceps pulley can be associated with LHBT instability. MRI external and internal rotation led to a better identification of structures of the biceps pulley and the detection of LHBT instability could suggest the presence of ASI.

B-0046 11:15

Ultrasound-guided percutaneous treatment of rotator cuff calcific tendinitis: randomised comparison between one- and two-needle procedure

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Purpose: US-guided percutaneous treatment of RCCT has been demonstrated to be effective using one or two needles,but direct comparison between the two methods has never been performed.Our aim was to compare the technical and one-year clinical outcome of these two approaches.
Methods and Materials: IRB approval and patients' informed consent were obtained.100 patients to be treated for RCCT (77females,mean age 46years,range 32-70y)were randomised into two groups.GroupA (50 patients;mean visual analogue scale[VAS]=7.8)was treated using an US-guided 16G double-needle technique (local anesthesia,washing with warm saline,intrabursal steroid),while groupB (50patients;mean VAS=7.4)was treated

using a 16G single-needle technique.Calcification appearance at US (fluid,soft,hard),procedure time and ease of calcium dissolution (subjectively scored as easy=1,intermediate=2,difficult=3)were recorded.VAS follow-up was performed at 1.3,6 and12 months.Complication rate was noted.Mann-Whitney U and Chi-square statistics were used.
Results: No immediate or delayed major complications were encountered.Overall procedure duration in group A (489±88s)was significantly shorter (P <.001)than duration in group B (684±187s).Difference in procedure duration and ease of calcium dissolution wasn't significant when dealing with fluid deposits (P=.683;P=.849),whereas it was significant for soft and hard deposits (P=.006 and P <.001;P=.004 and P <.001,respectively).Post-procedure bursitis occurred in 4/35 patients after 61±10days in group A and in 5/35patients after 56±7days in group B (P=.874).In group A,VAS was 3.1±0.2 at 1 month,1.8±0.3 at 3 months,1.4±0.2 at 6 months,1.0±0.3 at 1 year,while it was 3.0±0.1.1.9±0.4.1.3±0.5.1.1±0.5 in group B (P≥.244).
Conclusion: One- and two-needle procedures are equally effective in treating RCCT with no major complications.Two-needle procedure allows for significantly reducing treatment time and appears to be much easier when dealing with soft and hard calcium deposits.

B-0047 11:24

Imaging-guided therapeutic shoulder injections: prospective study comparing the lateral extension of the acromion on conventional radiographs with patients' outcomes

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Purpose: To compare the lateral extension of the acromion on conventional radiographs with patient improvement in pain and shoulder function after subacromial and glenohumeral injections.
Methods and Materials: Institutional review board and informed consent were obtained. Totally 307 patients were prospectively included after therapeutic fluoroscopy-guided subacromial (n= 148 patients) or glenohumeral injections (n= 159 patients) with local anaesthetics (lidocaine 2%) and long-acting corticosteroids (40 mg of triamcinolone). Post-interventional outcomes were assessed by the patient's global impression of change (PGIC) and visual analogue scale (VAS) pre-injection and at 1 week and 1 month post-injection. Two observers quantified the lateral extension of the acromion by the critical shoulder angle (CSA) and the acromion index (AI) on anteroposterior conventional radiographs. ANOVA and Chi-squared test served for statistics.
Results: Relevant 'improvement' one month after subacromial injection was observed in 63% of patients compared to 64% of patients after glenohumeral joint injection. Comparing the three CSA categories after subacromial injection showed a higher percentage of 'improved' patients at 1 week (68.2% versus 45.1%) and significantly lower pain levels on the VAS scale at 1 month (2.2 ± 1.9 versus 3.4 ± 3.0, $p = 0.027$) in patients with a short lateral extension of the acromion. No significant association was noted between the clinical outcome (PGIC and VAS scale) and the lateral extension of the acromion (CSA & AI) after glenohumeral joint injections.
Conclusion: Shorter lateral extensions of the acromion were related with better clinical outcomes in subacromial injections but not in glenohumeral injections patients.

B-0048 11:33

Ultrasound-guided percutaneous injection for De Quervain's disease using three different techniques: preliminary results of a randomised controlled trial

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Purpose: De Quervain's disease is a painful stenosing tenosynovitis of the first dorsal compartment of the wrist, caused by a thickening of the retinaculum. Ultrasound-guided intracompartmental steroid injections reported pain relief in up to 97% of patients at 6 months follow-up with a rate of symptoms recurrence up to 20%. We compared the efficacy and the outcome at 6 months follow-up of three different ultrasound-guided treatment options for De Quervain's disease.
Methods and Materials: Excluding women with pregnancy-related disease, a consecutive series of 26 patients who presented at our institution to be treated for De Quervain's disease under ultrasound guidance entered our study. Baseline and follow-up (1, 3, 6 months) evaluation included US measurement of first dorsal compartment retinaculum maximum thickness, pain assessment (VAS) and disability assessment (quickDASH). All procedures were performed under US guidance with axial scan over the first extensor compartment, and using a medial-to-lateral approach. Patients were randomised into three groups: 1 ml metilprednisolone acetate (group 1; 8 patients, mean age 39±10years, mean baseline thickness=1.6 mm, mean baseline VAS=6.4, mean baseline quickDASH=53), 1 ml triamcinolone acetonide+15-day-delayed 2 ml saline 0.9% (group 2; 8.44±9.1.3.6.0.56), and 1 ml triamcinolone acetonide+15-day-delayed 2 ml low-weight sodium hyaluronate (group 3; 10.43±12.1.7.6.4.55).
Results: No adverse reactions occurred. At 1-month follow-up we found: group 1, mean thickness=0.5 mm, mean VAS=1.5, mean quickDASH=22; group 2, 0.6.1.4.23; group 3, 0.5.1.2.21. At 3-month follow-up: 0.5.1.1.21; 0.6.1.2.21; 0.4.1.1.21. At 6-month follow-up: 0.8.3.4.32; 0.6.2.1.26; 0.5.1.0.19. VAS and quickDASH are graphically represented in Figure 1.
Conclusion: Ultrasound-guided intracompartment injection of triamcinolone acetonide+sodium hyaluronate seems to represent a promising approach to treat De Quervain's disease, reducing symptoms recurrence up to 6 months.
Author Disclosures:
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B-0049 11:42

Ultra high-resolution C-arm CT arthrography: initial results in- and ex-vivo

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Purpose: To report on initial results of direct C-arm CT arthrography using a 1x1 binning ultra high-resolution detector read-out.
Methods and Materials: Direct bi- or tricompartmental arthrography of the wrist was conducted according to standard procedures under fluoroscopic guidance in 5 patients and 5 cadavers using an iodinated contrast agent (Imeron 300, 1:1 dilution with NaCl) for C-arm CT or a mixture of an iodinated and a gadolinium-based contrast agent (Imeron 300, Bracco and Magnevist 2 mmol/l, Bayer, 1:1) for combined CT/MRI. C-arm CT images were acquired on a monoplanar angiography unit (Artis Q, Siemens, Erlangen, Germany) using a 1x1 binning detector read-out with a field-of-view of 22 cm. Subjective and objective image quality and patient workflow were compared with conventional thin-collimated MDCT (ex-vivo) and 3 T MRI (in-vivo), respectively.
Results: Image quality of C-arm CT arthrography was rated significantly higher as compared to MDCT/MRI arthrography with respect to the delineation of intrinsic ligaments, TFCC, cartilage, subchondral bone plates and trabecular architecture. However, MRI added supplemental information on (teno-)synovitis, bone marrow edema and soft-tissue injury. C-arm CT considerably improved the patient workflow by enabling joint injection and CT scan at a single modality as compared with the traditional two-step procedure.
Conclusion: Ultra high-resolution C-arm CT arthrography shows superior depiction of intraarticular structures and improves patient workflow as compared to MDCT/MRT arthrography.
Author Disclosures:
C. Von Falck: Research/Grant Support; Visage Imaging. **B. Meyer:** Research/Grant Support; Visage Imaging, Siemens Healthcare. **F. Wacker:** Research/Grant Support; Visage Imaging, Siemens Healthcare.

B-0050 11:51

Metallic artefacts from internal scaphoid fracture fixation screws: comparison between C-arm flat-panel, cone-beam and multi-detector CT

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Purpose: To systematically compare artefact degree and image quality from scaphoid fracture fixation screws between different CT modalities and radiation dose protocols.
Methods and Materials: CT acquisitions were acquired from six cadaveric wrists with scaphoid screws in two different scanning positions (45° and 90°) with MDCT, C-arm-based flat-panel (FP) and cone-beam (CB) CT, the latter two with low- and standard radiation dose protocols each. Two radiologists measured the mean cartilage attenuation and metal artefact-induced absolute HU changes (=artefact extent) and evaluated different kinds of image quality criteria, e.g. visualisation of the screw bone interface and artefacts degree, using a five-point Likert-scale. Interreader-agreements were calculated (ICCs; Cohen's Kappa) and mean absolute HU changes and ratings compared using Friedman and Wilcoxon signed-rank tests.
Results: ICC and Kappa for Interreader-agreement were 0.58 and 0.51, respectively. Mean cartilage attenuation did not differ significantly among modalities and no significant differences in artefact extent among different screw types and scanning positions were noted ($p > 0.05$). In CBCT low- and standard-dose acquisitions, significantly higher artefact extent emerged compared to MDCT and FPCT ($p < 0.05$). Image quality was significantly better ($p < 0.05$) and artefact degree significantly lower ($p < 0.001$) in MDCT compared to both other modalities. Screw bone interfaces were better visible in FPCT compared to CBCT ($p < 0.05$).

Conclusion: MDCT has shown less metal-induced artefacts and better overall image quality than FPCT and CBCT. However, FPCT and CBCT still provide sufficient image quality to serve as low-radiation-dose alternatives for postoperative scaphoid bone imaging in future.

10:30 - 12:00 **Room E2**

Breast

SS 102a

Contrast and spectral mammography

Moderators:
I. Pereira; Ourém/PT
F. Thibault; Paris/FR

B-0051 10:30

Tumour size: dual-energy contrast-enhanced digital mammography (CEDM) versus breast MRI

I. Leconte, M. Teodorescu, N. Michoux, L. Fellah; *Brussels/BE (marian.teodorescu@uclouvain.be)*

Purpose: Evaluation of the tumour size in patients with breast tumors using dual-energy contrast-enhanced digital mammography and MRI.
Methods and Materials: Twenty-two patients with 30 breast tumours (29 malignant, 1 benign) underwent contrast-enhanced digital mammography (CEDM) and MRI before surgery. Images were read twice by two senior radiologists. Inter-observer agreement and inter-technique agreement (mean measurement from both observers) with regard to the size of the lesions were assessed based on the intraclass correlation coefficient ICC (two-way model for an absolute agreement where systematic differences are relevant) and its 95% confidence interval.
Results: Median size of the lesions at histology was 12 mm [4 mm; 200 mm]. Inter-observer agreement was excellent for both modality (ICC^{MRI} = 0.995 [0.987 - 0.998], ICC^{CEDM} = 0.997 [0.994 - 0.999]). Inter-technique agreement was excellent between CEDM and histopathology (ICC = 0.943 [0.882 - 0.972]) and slightly superior to the one observed between MRI and histopathology (ICC = 0.850 [0.707 - 0.927]).
Conclusion: Both CEDM and MRI offer reliable means of evaluation of tumour size with an excellent reproducibility of measurements. CEDM is at least as efficient as MRI for evaluating tumour size.

B-0052 10:39

Can contrast-enhanced spectral mammography replace magnetic resonance imaging in the detection and staging of breast cancer?

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Purpose: To evaluate the diagnostic performance of contrast-enhanced spectral digital mammography (CEM) versus dynamic contrast-enhanced magnetic resonance imaging (DCE-MR) in the detection and staging of breast cancer.
Methods and Materials: In this institutional ethics approved prospective study, we compared the performance of CEM with MRI on 70 patients. Standard digital mammogram was done in the mediolateral oblique and craniocaudal projections followed by low (22-33 kVp) and high (44-49 kVp) energy exposures in the same projections. DCE-MR was set in the axial orientation and post processed using maximum intensity projection and multiplanar reconstruction images. Both examinations performed by IV injection of non-ionic contrast agent. Outcomes of the surgical specimen or ultrasound guided core biopsy were the gold standard of reference.
Results: The study included 33 benign (47%) and 37 (53%) malignant breast lesions. The areas of contrast uptake had been correlated with abnormalities seen on the conventional mammography. Both CEM and MRI were individually assessed in the same group of cases. Multicentric and multifocal carcinomas were detected by contrast mammograms in 29.7% (n=11) of malignant cases, when only unifocal carcinoma was reported on conventional mammograms. In the contest of malignancy, both modalities stood on the same land. Enhancement detection of some benign lesions (n=5) was limited in CEM. Statistical analysis yielded a sensitivity, specificity and accuracy of 93.7%, 66.6% and 80.6% compared to 93.7%, 86.6% and 90.3% for CEM and MRI, respectively.
Conclusion: CEM is non-inferior to breast MRI in the detection and characterisation of breast malignancy.

B-0053 10:48

Contrast-enhanced spectral mammography in women referred from the breast cancer screening programme

M. Lobbes, U.C. Lalji, J. Houwers, P. Nelemans, M. Smidt, E. Heuts, J.E. Wildberger; *Maastricht/NL (marc.lobbes@mumc.nl)*

Purpose: Previous results showed that contrast-enhanced spectral mammography (CESM) could increase diagnostic performance of mammography. Diagnostic performance of CESM in a population with low disease prevalence (30%) was not evaluated before.
Methods and Materials: Women referred from breast cancer screening underwent CESM. Two radiologists blinded for diagnosis provided BI-RADS classifications for conventional mammography and CESM. Statistical significance of differences between mammography and CESM was calculated using McNemar's test and receiver operating characteristic (ROC) curves were constructed for both imaging modalities. Bland-Altman plots were created to evaluate agreement between tumour diameter as measured by CESM, MRI, and pathology.
Results: 113 women were included (age 49-73 years). When compared with conventional mammography, CESM increased sensitivity to 100.0% (+3.3%), specificity to 87.7% (+45.7%), PPV to 76.2% (+36.5%), and NPV to 100.0% (+2.9%). Differences between conventional mammography and CESM were highly significant ($p < 0.0001$). A similar trend could be observed for the ROC curve. For conventional mammography, the AUC was 0.779. With CESM, AUC increased from 0.197 to 0.976 ($p < 0.0001$). Excellent agreement between tumour diameter measured by CESM and breast MRI was observed, with a mean difference of 1.0 mm with 95% limits of agreement of 8.3 mm. Excellent agreement was also observed for the comparison of tumour diameter assessed by CESM and histopathology, with a mean difference of 1.4 mm, but with larger 95% limits of agreement of 25.0 mm.
Conclusion: CESM significantly increases the diagnostic performance of conventional mammography, even in patient cohorts with a low prevalence of breast cancer.

B-0054 10:57

Radiation exposure of contrast enhanced spectral mammography compared to conventional mammography

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Purpose: Contrast-enhanced Spectral Mammography (CESM) shows promising initial results, but comes at the cost of an increased dose as compared to conventional mammography (Mx). Dromain reported a dose increase of 20%, it being the only study adressing this issue. As CESM could substitute Mx, our purpose is to assess dose increase of CESM with respect to Mx.
Methods and Materials: We retrieved radiation exposure related data (kV, compressed breast thickness, glandularity, Average Glandular Dose (AGD)) for 60 CESM and 344 Mx patients. All examinations were performed on the same mammograph (GE Senograph Essential/Senobright). The CESM examination exists of a low (kV=26-31 kV, Mo/Rh or Rh/Rh) and high energy (kV=45-49, Mo/Cu or Rh/Cu) exposure after administering iodine contrast. A conventional (low-energy) as well as a contrast-enhanced (high-energy) mammogram are obtained. Radiation dose values reported by the mammograph were validated by phantom measurements.
Results: Dose values reported by the system were in accordance with our measurements. Mean ± SD AGD for a single low and high energy CESM exposure was 2.12±0.68 mGy and 0.68±0.22 mGy, respectively. The AGD depends on compressed breast thickness and glandularity. Combined radiation exposure was 2.80±0.88 mGy. Mean AGD for a single Mx exposure was 1.55±0.48 mGy, which is significantly lower than the low energy CESM exposure ($p < 0.001$).
Conclusion: Compared to Mx, total radiation exposure of CESM is significantly increased by 63%. This increase is different from previously reported finding and presumably caused by differences in automatic exposure control settings between CESM and Mx.

B-0055 11:06

The added value of dual-energy contrast-enhanced digital mammography in breast cancer diagnosis

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Purpose: To determine the benefit of dual-energy contrast-enhanced digital mammography (CESM) performance in breast cancer diagnosis.
Methods and Materials: 120 women, aged from 28 to 85 years (median age 56.4 years), with suspicious finding (s) in conventional digital mammography, breast ultrasonography, or breast MR, underwent dual-energy CEDM in our Radiology Department. The evaluation of the low-energy image was based on morphology of the lesion (s). High-energy image evaluation was based on the

strength of contrast enhancement intensity, according to a qualitative scale of contrast enhancement intensity, categorised in 4-steps. Type 0= no enhancement, type 1= very low enhancement, type 2= moderate enhancement, type 3= intense enhancement. Type 0 and type 1 findings were considered to be probably benign, while type 2 and type 3 findings were considered to be probably malignant. Histopathological analysis of the suspect breast lesions was performed in all patients, after core or surgical biopsy.
Results: Histopathology confirmed 58 malignant and 62 benign lesions. There was excellent correlation between proven breast malignancy and moderate or intense lesion enhancement (53 of 68), as well as between benign lesions and no, or very low enhancement (47 of 62). According to our findings, the positive predictive value of the method is 78% the negative predictive value is 90%, the specificity is 77% and the sensitivity is 91%.
Conclusion: Dual-energy CEDM can be used as a useful adjunctive tool and a problem-solving method to diagnostic conventional mammography in every-day practice.

B-0056 11:15

Contrast-enhanced digital mammography: is it useful in detecting lesions in oedematous breast?
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Purpose: To investigate the potential of using intravenous contrast material with full-field digital mammography to facilitate the detection and characterisation of lesions in the oedematous dense breast.
Methods and Materials: The study included 36 Egyptian patients (age ranged from 37 to 62 years, mean = 49.5 years) presenting by swollen breasts or coming for follow-up after treatment either by chemotherapy or conservative breast surgery. They underwent both conventional mammography and high-energy post-contrast digital mammography and ultrasound breast examination.
Results: Two radiologists analysed the presence and pattern of contrast uptake. Enhancement was detected in 23 cases and no detectable enhancement in 13 cases. Two false negative cases were detected (one invasive carcinoma post chemotherapy and one duct carcinoma in situ). Two false positive cases were also detected (one diffuse granulomatous mastitis and one diffuse interstitial mastitis). The calculated sensitivity, specificity, positive and negative predictive values of CEDM were 93.9%, 89.6%, 93.9% and 89.6%, respectively, as compared to 85.6%, 55.1%, 76.3% and 69.3% for FFDM.
Conclusion: Dual-energy contrast-enhanced digital mammography is a useful technique in identification of lesions in mammographically dense oedematous breasts and capable of demonstrating lesions that are not visible at standard mammography. CEDM is useful in follow-up of cases presenting by edema after conservative breast surgery and chemotherapy.

B-0057 11:24

Characterisation of breast lesions with spectral mammography: results on tissue specimens and first clinical cases
F. Kilburn-Toppin[1], P. Willsher[2], K. Erhard[3], E. Fredenberg[4], E. Moa[4], D. Dance[5], M.G. Wallis[2]; [1]*Bury St Edmunds/UK*, [2]*Cambridge/UK*, [3]*Hamburg/DE*, [4]*Solna/SE*, [5]*Guilford/UK (fleurkt@doctors.org.uk)*

Purpose: Round lesions are a common mammographic finding; techniques to improve characterisation at screening may reduce recalls. Our study aims to determine x-ray attenuation of solid breast lesion specimens to establish whether they could be distinguished from cystic lesions by spectral imaging (SI).
Methods and Materials: 73 fixed tissue samples of solid breast lesions, 50 samples of cyst fluid and 50 of water were imaged on a prototype Philips MicroDose SI mammography system. Energy dependent x-ray attenuation was measured from the photon counts in the high and low-energy images and mapped to equivalent thicknesses of aluminium and polymethyl methacrylate. In addition, 40 cysts and 26 solid lesions in 56 women have been imaged and characterised in vivo on a CE-marked clinical SI system following delineation of each lesion by a radiologist.
Results: 25 fixed tissue samples were excluded (DCIS/benign/technical reasons). Attenuation of the remaining 48 biopsy proven malignant samples was significantly different from cyst attenuation at 95% significance level. Standard deviation of the attenuation of tumours was 2-4 times larger than cyst samples, and 7-14 times larger than water samples. 2 of the fixed tumour samples overlapped with the distribution of cyst fluid samples. On the clinical system, our initial algorithm has correctly predicted all solid lesions.
Conclusion: Results demonstrate large sample variability but only small overlap between attenuation of cyst fluid and fixed tumour samples, suggesting it may be possible to distinguish cystic from solid lesions. Initial clinical results are promising, justifying continuing a clinical study.
Author Disclosures:
K. Erhard: Employee; Philips. **E. Fredenberg:** Employee; Philips. **E. Moa:** Employee; Philips. **M. Wallis:** Grant Recipient; Philips.

B-0058 11:33

Added value of contrast-enhanced spectral mammography (CESM) as part of a one stop breast unit
A.-M. Tardivel, C.S. Balleyguier, S. Canale, S. Delaloge, C. Mazouni, M.-C. Mathieu, C. Dromain; *Villejuif/FR (am_tardivel@hotmail.com)*

Purpose: To assess the added value on treatment management of contrast-enhanced spectral mammography (CESM) in adjunct to mammography and ultrasound in breast cancer in One Stop Breast unit.
Methods and Materials: 152 women with a suspicious or undetermined breast lesion on mammogram ± ultrasound underwent bilateral CESM in a one shot breast post-screening unit between September 2012 and June 2013. CESM images were blindly retrospectively reviewed by two radiologists, to estimate BI-RADS categories and probability of malignancy (7 categories scale). Each lesion was confirmed histologically or by follow-up for typical benign lesions. Diagnostic performances were estimated. Changes of medical and surgical strategy were recorded.
Results: 223 lesions were detected including 174 malignant lesions (137 infiltrative ductal carcinoma, 19 lobular infiltrative carcinoma, 8 ductal carcinoma in situ) in 124 / 152 patients (82%). CESM sensitivity, specificity, positive predictive value and negative predictive value were 94%, 71%, 92% and 76%, respectively, with 14 false-positive and 11 false-negative findings. CESM changed diagnostic and treatment strategy in 33 (22%) patients, detecting additional malignant lesions in 22 patients, with a more extensive surgery (n=21) and neoadjuvant chemotherapy (n=1). A biopsy was avoided in 11 patients with negative CESM, for whom a benign lesion was confirmed by follow-up. Diagnostic and treatment changes according CESM were independent from breast density, tumour type and mammographic/sonographic findings.
Conclusion: CESM may be performed easily in One Stop Breast unit and may change significantly the diagnostic and treatment strategy in breast cancer staging.

B-0059 11:42

Second-look digital breast tomosynthesis (SL-DBT) in assessing incidental findings (IFs) at contrast-enhanced magnetic resonance imaging (CE-MRI) in patients with newly diagnosed breast cancer
P. Clauser[1], A. De Nicolò[1], V. Londero[1], R. Girometti[1], C. Zuiani[1], M. Bazzocchi[1], F. Sardanelli[2]; [1]*Udine/IT*, [2]*San Donato Milanese/IT (clauser.p@hotmail.it)*

Purpose: To test if SL-DBT, i.e. the re-evaluation of DBT images after CE-MRI, helps assessing IFs at CE-MRI in patients with newly diagnosed breast cancer.
Methods and Materials: Two experienced readers in consensus retrospectively reviewed the examinations of 43 patients who underwent DBT and CE-MRI from May 2012 to January 2013, looking for a DBT correlate of IFs at CE-MR. Standard of reference was histology for CE-MRI suspicious findings (ACR-BIRADS-3-5) and imaging follow-up for CE-MRI non-suspicious findings (ACR-BIRADS-1-2). Fisher exact test was used.
Results: A total of 32 CE-MRI IFs were detected in 24 patients: 18 BIRADS-2 and 14 BIRADS-3-5. A DBT correlate was found in 12/24 IFs (38%) overall, 8/14 (57%) MR-BIRADS-3-5 and 4/18 (22%) MR-BIRADS-2 IFs, with borderline significance (p=0.080). Malignancy was histologically confirmed for 10/14 CE-MRI IFs; 6 of these 10 additional malignancies (60%) had a DBT correlate with suspicious features: 3 invasive lobular; 2 ductal carcinoma in situ; and 1 invasive ductal. A significantly lower rate of DBT correlate (6/22, 27%), was found for non-suspicious CE-MRI IFs, all with benign features (p=0.005).
Conclusion: A DBT correlate was more frequent for malignant than for benign CE-MRI IFs. SL-DBT has the potential to confirm more than 50% of suspicious CE-MR IFs. However, the absence of a DBT correlate does not warrant to avoid MR-guided biopsy.

B-0060 11:51

The 3D mammography: the imaging of the future?
R. Ferré[1], C.S. Balleyguier[2], P. Goumot[3], B. Mesurolle[1]; [1]*Montreal, QC/CA*, [2]*Villejuif/FR*, [3]*Paris/FR (kn638@yahoo.fr)*

Purpose: To assess the benefit of real three-dimension mammogram (3DSDM) in diagnosis improvement and cancer detection in comparison with 2D digital mammography.
Methods and Materials: The 3DSDM is processed by an additional low-dose image acquired with a 4-degree angulation compared to cranio-caudal acquisition. This acquisition time takes 1 minute more and the dose is 30% lower. The resolution is 50 µm. Both images are treated as a stereo-pair in the 3DSDM system. Monitor allows magnification, and 2D and 3D can be switched as well. 1110 mammograms were performed from March 2012 until April 2013, including 1075 patients whose mean age was 60 (21.91). The study was prospective and board-approved. 3 radiologists who were blinded to each other

results read 2D then 3D mammograms and evaluated 3D benefit with a 3-level scale : 0 for no benefit, 1 for moderate and 2 for excellent. All cases of cancers were histologically proven and were also evaluated.
Results: For 958 mammograms (86%), the readers had the same opinion about the benefit of 3DSDM : grade 0, 1 & 2 were quoted in 8, 52 and 26% of cases. Discordance was not influenced by BIRADS classification (heterogenity test : p = 0.55) neither with microcalcification or masses (heterogenity test : p = 0.80). The readers had the same opinion of cancers in 96% of cases with a moderate and excellent benefit (50% and 42% respectively).
Conclusion: 3DSDM is a new helpful tool to interpret mammograms and particularly in a significantly higher cancer detection rate.

10:30 - 12:00 **Room F1**

Oncologic Imaging

SS 116

Imaging in response assessment: methodology and clinical results

Moderators:
K.S. Lee; Seoul/KR
M. Nadrljanski; Belgrade/RS

B-0061 10:30

Correlation of radiological presentation and response to TKI targeted therapy in EGFR mutant and ALK rearranged advanced lung adenocarcinomas patients
N. Moussa, C. Leduc, L. Faivre, J. Pignon, B. Besse, C. Dromain, C. Caramella; *Villejuif/FR (ndi.moussa@gmail.com)*

Purpose: Amongst caucasian patients with lung adenocarcinoma, around 15% exhibit epidermal growth factor receptor mutation (EGFRm) or anaplastic lymphoma kinase rearrangement (ALK+). These tumours are associated with a high response rate to specific targeted treatments, but the impact of the radiological presentation on the treatment benefit is poorly known.
Methods and Materials: We retrospectively reviewed patients with advanced non-small cell lung cancer harbouring EGFRm and/or ALK+ that were included in a clinical trial at Gustave Roussy (MSN trial). A central review of all the baseline clinical characteristics and CT images was performed to assess initial tumour volume (volumetry software program LungVCAR, GE Healthcare), number and type of metastatic lesions (brain, lung, adrenal, liver, bone). EGFRm tumours were treated with gefitinib or erlotinib, and ALK+ tumours with crizotinib. Multivariate statistical analyses were performed to correlate with progression-free survival (PFS).
Results: Between june 2006 and january 2013, 405 patients were included in the MSN. Amongst them, 97 patients were eligible, 80 EGFRm, 14 ALK+, 3 with both. There was no statistically significant difference between oligometastatic (< 3 sites) and polymetastatic patients and according to volume tumour (< 35, 36-75 and > 75 cm^3). None of the clinical characteristics of the metastatic site had a detrimental effect on PFS, including 43 patients with brain metastasis.
Conclusion: In patients with EGFRm or ALK+ lung cancer under targeted therapy, the initial tumour burden or the presence of brain metastases was not correlated with a poorer benefit.

B-0062 10:39

Radio-pathological correlation in HCC treated by transarterial chemoembolisation: comparison between RECIST, mRECIST and EASL criteria
M. Dioguardi Burgio[1], M. Ronot[2], O. Bruno[2], C. Francoz[2], V. Paradis[2], F. Durand[2], L. Castera[2], J. Belghiti[2], V. Vilgrain[2]; [1]*Palermo/IT*, [2]*Clichy/FR (marco_dioguardi@hotmail.it)*

Purpose: To compare the performances of RECIST1.1, mRECIST, and EASL criteria for tumoural necrosis evaluation in a consecutive series of patients treated with transarterial chemoembolisation (TACE) before liver transplantation (LT) for hepatocellular carcinoma (HCC).
Methods and Materials: Between 2006 and 2012, all patients treated with at least one session of TACE before LT for HCC were identified. Response to treatment was evaluated by 2 independent readers on the last CT before LT according to RECIST1.1, mRECIST, and EASL criteria. Imaging response was compared to the tumoral necrosis assessed by pathology on the liver explant. Inter-reader agreement for the tumoural response was evaluated by the kappa statistic. Factor associated with a major (> 90%) necrosis were tested by multivariate analysis.
Results: Population included 58 patients with 88 HCC treated with 94 TACE sessions. 51 nodules (58%) showed major necrosis. Among them, lesions were classified as complete response according to RECIST1.1, mRECIST and EASL in 2 (4%), 47 (92%) and 47 (92%) for reader 1, respectively, and 1 (2%), 45 (88%) and 45 (88%) for reader 2, respectively. Despite similar performances with mRECIST and EASL, only mRECIST was correlated with major necrosis on multivariate analysis for both readers ($p < 0.0001$). Inter-observer agreement was substantial for RECIST1.1 ($k=0.65 \pm 0.08$), mRECIST ($k=0.78 \pm 0.07$), and EASL ($k=0.75 \pm 0.07$).
Conclusion: mRECIST and EASL criteria showed better correlation with major tumoural necrosis than RECIST1.1. mRECIST showed better correlation with tumoural major necrosis and should be used to evaluate response to TACE.

B-0063 10:48

Investigating changes in tumour volumes for defining limits for stable disease by total tumour volumetry criteria in therapy response assessment of hepatocellular carcinoma
A. Singh, W. Cai, S. Saini, G. Harris; *Boston, MA/US (ahsingh@partners.org)*

Purpose: Limits for stable disease according to total tumour volumetry (TTV) criteria have been set between -65 and +73% change in total tumour volume after treatment and is basically derived from extrapolation of bi-dimensional RECIST-based measurements lacking validation for specific tumour groups. Our aim is to generate receiver-operating-characteristic (ROC) curves for defining a more reliable limit for stable disease for assessing therapy response in Hepatocellular carcinoma's (HCC) with total tumour volumetry criteria.
Methods and Materials: Consecutive pre-treatment and post-treatment MDCT datasets of 63 consecutively treated HCC patients were obtained for estimation of interval change in total tumour volume (TTV) using semi-automated 3D segmentation techniques. Area-under-curve (AUC) was generated for various thresholds (±20%, ± 30%, ± 40%, ± 50%, ± 60%, ±70%) along with the current proposed TTV stable disease inclusion limits (-65 to +73% change). Progression-free survival time from start of treatment was used as dependent variable.
Results: The stable limit range for total tumour volumetry criteria between ±50% revealed a better AUC [AUC=0.727; 95%CI=0.60-0.83] compared to other set limits for stable disease. The stable range set at ±60% was also closer to most optimum (AUC=0.707). The ROC-AUC for existing TTV criteria for stable disease (-65 to +73%) was less than the above two ranges (AUC=0.688).
Conclusion: Better prediction of therapy response in HCC by TTV criteria was achieved by setting limits of stable disease between ±50 and ±60% in this study compared to currently proposed limits of -65 to +73%, thus necessitating further validation on larger cohort.
Author Disclosures:
A. Singh: Grant Recipient; NIH/NCI Proton beam federal share grant (PI) 2012 & 2013; Sarcoma Foundation of America 2010 Grant -PI; RSNA 2009 fellow grant -PI. Research/Grant Support; RSNA fellow grant 2009; NIH/NCI Proton Beam Federal Shre Grant. **S. Saini:** Consultant; GE HEALTHCARE, PHILIPS, BRACCO. **G. Harris:** Advisory Board; Fovia Inc.

B-0064 10:57

What does FDG-PET activity tell us about morphological changes in colorectal liver metastasis treated with bevacizumab?
A.R. Seyal, F.D. Gonzalez-Guindalini, K. Parekh, P. Nikolaidis, V. Yaghmai; *Chicago, IL/US (v-yaghmai@northwestern.edu)*

Purpose: To evaluate correlation of FDG-PET uptake with morphological changes of colorectal liver metastases treated with bevacizumab.
Methods and Materials: This HIPAA compliant study was IRB approved. Fifty-four colorectal liver metastases in 22 patients treated with bevacizumab were evaluated. For each patient, pre- and post-therapy CT scans and post-therapy FDG-PET scan were evaluated. Based on FDG-PET, lesions were classified in two groups: Responder (no uptake) or non-responder (positive uptake). Two experienced abdominal radiologists blinded to FDG-PET results analysed the CT images for changes in tumor morphology and categorised them as responders (sharp margin) and non-responders (irregular margin).
Results: The mean interval time between the post therapy CT and FDG-PET was 8 days. Based on tumor morphology, 12/54 (22.2%) lesions were classified as responders and 42/54 (77.8%) lesions as non-responders. The number of responder and non-responder lesions based on FDG-PET uptake were 20/54 (37%) and 34/54 (63%), respectively. FDG-PET and tumor morphology were concordant for response category in 40/54 (74.1%) metastases. 3/54 (5.6%) metastases were classified as responders based on morphology but demonstrated FDG-PET uptake after therapy, while 11/54 (20.3%) metastases classified as non-responders based on morphology showed no uptake on post treatment FDG-PET. The FDG-PET sensitivity, specificity, PPV and NPV to predict response based on tumor morphology were 75%, 73.8%, 45% and 91.2%, respectively. FDG-PET predicted tumor morphology (odds ratio: 8.45; 95% C: 1.93-37.03; P=0.005).
Conclusion: Changes in colorectal liver metastasis morphology and FDG-PET uptake show high concordance in patients treated with bevacizumab.

Author Disclosures:
A.R. Seyal: Research/Grant Support; Educational Grant from Siemens Healthcare. **K. Parekh:** Research/Grant Support; Educational Grant from Siemens Healthcare.

B-0065 11:06

Very high-resolution ultrasound and elastography in melanoma lesion: US-pathological correlations

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Purpose: The aim of this study was to evaluate the very high-resolution ultrasound (US) in assessment of preoperative melanoma, especially by correlation between US thickness of melanoma and the histopathological thickness (Breslow index), being known that Breslow index positively correlates with the probability of lymph node involvement and the risk of distant metastasis.
Methods and Materials: The study included 28 melanoma lesions identified on 25 patients. A Ultrasonix equipment with 20-40 MHz linear transducer was used for US evaluation. The relation between values obtained by 2D US evaluation of the lesions (thickness and elastographic appearance) and value obtained by histopathological examination (Breslow index) was investigated.
Results: The mean age of the investigated subject was of 57±15 years old. Most investigated lesions were localised at lumbar region (17.86%, 95%CI [7.27-35.59], where CI = confidence interval) and had a hypoecogen homogenous 2D US aspect in 71% of cases (95%CI [50.13-85.59]). The elastographic aspects of lesions were low or medium intensity in 43% and 39% respectively. The US thickness (2.38±1.41 mm) proved significantly correlated with Breslow index (2.61±1.19 mm) (r=0.9335, p=8.14•10-11). Furthermore, the elastographic appearance of the lesion significantly correlated to both US thickness (ρ=-0.490, p = 0.008) and Breslow index (ρ=-0.440, p=0.036).
Conclusion: The strong linearity between US thickness and Breslow index obtained in our study and significant relation between elastographic appearance of the lesion and Breslow index sustain the usefulness of US and elastography in the assessment of skin melanoma lesions.

B-0066 11:15

The tumour response assessed with CT at 8 weeks from start of first-line chemotherapy correlates with overall survival in metastatic colorectal cancer

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Purpose: To study the relationship between early tumour response assessed by computed tomography (CT) eight weeks from baseline and overall survival (OS) in patients receiving first-line chemotherapy for metastatic colorectal cancer (mCRC).
Methods and Materials: A total of 520 patients who received bolus 5-fluorouracil/folinic acid and oxaliplatin (Nordic FLOX), with or without cetuximab, as first-line treatment for CRC in a randomised multicenter trial (NORDIC VII, n=566), were eligible for this sub-study. Radiological response was analysed according to response evaluation criteria in solid tumours (RECIST 1.0). The relationship between the percentage change in sum of tumour diameters from baseline to the first CT response evaluation and OS was investigated by using Cox proportional hazards multiple regression model and Kaplan-Meier survival analyses.
Results: Forty percentage decrease or more in the sum of tumour diameters was a positive prognostic factor for OS. Any other magnitude of change in size, even 20% or more increase (corresponding to progressive disease by RECIST 1.0) did not indicate shorter OS. A patient who had appearance of new lesion (s) or progression of non-target lesion (s) had a significantly shorter OS in both uni- and multivariate analyses.
Conclusion: Radiological tumour response assessed by CT at eight weeks was related to outcome; a more than 40% decrease in tumour size was associated with long OS, while appearance of new lesion (s) or progression of non-target lesion (s) was a strong negative prognostic factor.

B-0067 11:24

Neoadjuvant radiochemotherapy response evaluation with MR and FDG-PET/CT in rectal cancer: predictive value of combined quantitative parameters of ADC and SUV compared with tumour regression grade at histology

D. Ippolito, P.A. Bonaffini, D. Fior, C. Capraro, C. Trattenero, S. Sironi; *Monza/IT (davide.atena@tiscalinet.it)*

Purpose: To determine the clinical value of functional imaging,combining quantitative parameters of ADC and SUVmax,before and after chemo-radiation therapy,in prediction of tumor response of patients with rectal cancer,correlated with tumor regression grade at histology.
Methods and Materials: A total of 45 patients with biopsy proven diagnosis of rectal carcinoma were enrolled in our study.All patients underwent whole body 18-FDG-PET/CT scan and a pelvic MR examination before (PET 1,MR 1) and after neoadjuvant chemoradiation therapy (PET2,MR2).MR scanning,performed on 1.5T magnet (Philips,Achieva),comprised T2-weighted multiplanar imaging and in addition DW images with b-value of 0 and 1000 mm²/sec.On PET/CT the SUVmax of rectal lesion were calculated in PET1 and PET2.The percentage decrease of SUVmax (ΔSUV) and ADC (ΔADC) value,from baseline to presurgical scan,were assessed and correlated with pathologic response classified as tumor regression grade (Mandard's criteria;TRG 1=complete regression,TRG5=no regression).
Results: At histology,according to Mandard's criteria,29 tumors (68%) showed complete or subtotal regression (TRG1-2) and were classified as responders;16 tumors (32%) were classified as non-responders (TRG3-5).Considering all patients,the mean values of SUVmax in PET 1 was higher than mean value of SUVmax in PET2 ($p < 0.001$),whereas mean ADC values was lower in MR 1 than MR2 ($p < 0.001$).The best predictors for TRG response were SUV2 (threshold of 4.4) and ADC2 (1.28x10-3 mm2/s),but combining in a single analysis median quantitative value,the PPV in predicting different group category response,related to TRG system,presented an overall AUC of 96%, higher than DWI (88.2%) or SUVmax (93.3%).
Conclusion: In era of PET/MRI scanner,combination of DWI and PET/CT represents the most feasible method to evaluate LARC patients,with accuracy values higher than those reported for other imaging technique.

B-0068 11:33

Comparison between portal phase CT attenuation values and dynamic contrast enhanced ultrasonography in the early evaluation of metastatic renal cell carcinoma patients treated with anti-angiogenic treatment

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Purpose: Our objective was to compare the evaluation using DCE-US at one month and the CT-scan with calculation of density at 2 months for the prediction of response in patients treated by tyrosine kinase inhibitors for metastatic renal cell carcinoma.
Methods and Materials: We performed DCE-US in one target at baseline and D30. We selected patients with contrast-enhanced portal phase CT at baseline and after 2 months to calculate PFS. Response assessment using the Response Evaluation Criteria in Solid Tumors and the modified Choi criteria (a region of interest encompassing drawn with Global Imaging software) was performed in 5 targets including the DCE-US tumor. Results were correlated to the PFS.
Results: A total of 81 patients were analysed. All had DCE-US at baseline and one month. Forty four patients had CT-scan with contrast media injection for Choi criteria analysis. The median of follow-up was 18 months. For DCE-US, the decrease of 90 % of AUC at D 30 was correlated to the PFS ($p = 0.01$). The difference of PFS between the groups defined by this cut-point was 4 months (bad responders) and 14 months (good responders). For the Choi criteria, the preliminary results seem to be efficient to predict PFS.
Conclusion: RECIST is not reliable to early identify good responders. DCE-US at one month could select patients with a poor PFS ($p < 0.01$) in order to change treatment. Tumor density analysis at 2 months seems to be a good indicator and will be confirmed with the final analysis.

B-0069 11:42

Comparing accuracy of dimensional and attenuation based criteria in predicting clinical outcome in patients with renal cell cancer treated with antiangiogenetic targeted therapy

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Purpose: Aim of the study was to compare the accuracy of different response assessment criteria in the early evaluation of patients with metastatic renal cell cancer (RCC) on antiangiogenic targeted therapy.
Methods and Materials: 44 patients with advanced RCC were studied. Standard contrast-enhanced CT (CECT) studies acquired before and three months after the onset of tyrosine-kinase inhibitor therapy were retrospectively evaluated. For each patient, response assessment to targeted therapy was evaluated using: Mass, Attenuation, Size and Structure (MASS) criteria; Size and Attenuation CT (SACT) criteria; modified Choi criteria (mChoi) and Response Evaluation Criteria in Solid Tumors (RECIST); sensitivity, specificity and accuracy were evaluated for each response criteria using as old standard the clinical outcome at 250 days from baseline.
Results: Identifying patients with a progression free survival at 250 days MASS and SACT had a sensitivity of 95.23% while mChoi and RECIST had a sensitivity of 100%; the specificity was respectively of 52.17%, 56.52%, 56.52%, 60.86%, and the accuracy of 72.72%, 75%, 77.27%, 79.54%. The negative predictive value (progression free disease at 250 days) was 92.3% for MASS, 92.85% for SACT and 100% for mChoi and RECIST, while the positive

predictive value was MASS 64.51%, SACT 66.66%, mChoi 67.74% and RECIST 70%.
Conclusion: Assessment of metastatic RCC target lesion on CECT, in a cohort of 44 patients treated with antiangiogenic targeted therapy, using dimensional and attenuation based methods shows in our casistic comparable predictive value performances, with slightly better results for RECIST, for a time to progression free cut-off of 250 days.

B-0070 11:51

Growth curves of renal masses from patients with von Hippel-Lindau disease

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Purpose: To analyse the progression curves of renal masses (RMs) in patients with von Hippel-Lindau disease (VHL), and propose some changes in their management.
Methods and Materials: This retrospective study included 26 VHL patients who underwent periodical magnetic resonance imaging (MRI) examinations as follow-up for renal masses. Thirty-one of total 60 RMs (51.7%) were classified as solid tumours (STs), and remaining 29 of 60 (48.3%) as complex cysts (CCs). For each lesion, the volume was estimated at each MRI occurrence using the ellipsoid approximation, and individual growth curves were traced. Variations in volume over time were analysed, and the mean growth rates (MGRs) calculated. MGRs were used to compare STs and CCs.
Results: In cases for which several imaging occurrences were available, the analysis of growth curves showed that solid tumours had an initial fast growth, followed by slower growth, according to the Gompertzian model. Otherwise, complex cysts showed some fluctuating progression curves, with spontaneous regressions in volume. Medians of the MGRs were 1.28 cm^3/y for STs and 0.37 cm^3/y for CCs, respectively, leading to statistically significant difference (P=0.0023), and indicating a growing process substantially slower for CCs than for STs.
Conclusion: This study showed that short-term MRI follow-up and multiple lesion volume measurements in VHL patients, would allow a more accurate estimation of the tumour growth curve, providing useful information to possibly postpone the lesion treatment. Less aggressive approach seems to be possible for complex cysts versus solid tumours.

10:30 - 12:00 **Room F2**

Breast

SS 102b

Elastography and breast interventions

Moderators:
A. Athanasiou; Paris/FR
R. Sinnatamby; Cambridge/UK

B-0071 10:30

Which ultrasound shear wave elastography parameter gives the highest diagnostic accuracy for solid breast lesions?

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Purpose: Shear wave elastography (SWE) shows promise in refining benign-malignant differentiation of solid breast masses during ultrasound examinations. However, published results show varying diagnostic performances of the SWE features, and it is still unclear which of the three numerical parameters obtained (maximum, mean and standard deviation of the tissue elasticity measurements within a region of interest) gives optimal diagnostic accuracy.
Methods and Materials: The shear wave parameters of 1,152 solid breast masses were recorded prospectively prior to histological examination. Four images were obtained in two orthogonal planes using the Aixplorer device (SuperSonic Imagine).The values (generated using an ROI of 2 mm placed over the area of highest Emean) from the four images were averaged. Suggested thresholds from the literature (50 kPa for Emean, 80 kPa for Emax and 7 for SD) were used to calculate the diagnostic accuracy. Differences were evaluated using the chi-squared test.
Results: The masses studied consisted of 791 cancers and 361 benign lesions. 63% of lesions were symptomatic (mean US size 20 mm) while 37% were screen detected (mean US size 13 mm). The diagnostic accuracy (the combination of sensitivity and specificity for cancer) for Emean was 84%. This was significantly higher than the diagnostic accuracy using EMax (81%, p=0.03) or SD (79%, p=0.001).
Conclusion: In this study the Emean measurements gave the highest diagnostic accuracy of the three shear wave parameters known to be of diagnostic value.

Author Disclosures:
K. Skerl: Research/Grant Support; I am a PhD student partly founded by SuperSonic Imagine.

B-0072 10:39

Shearwave elastography improves the diagnostic accuracy in the characterisation of benign and malignant breast lesions

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Purpose: Shear wave (SW) elastography is an ultrasound technique based on tissue stiffness and provides quantitative information of breast lesions elasticity. We aim to investigate the diagnostic value of breast SW elastography in differentiating between benign and malignant lesions.
Methods and Materials: One hundred and sixty-six lesions in a total of 161 patients were examined by conventional ultrasound and SW elastography using Aixplorer® (SuperSonic Imagine, France). The lesions were assessed using B-mode and SW parameters were recorded (mean, maximum, and minimum elasticity of stiffest portion of lesion and surrounding tissue; lesion-to-fat elasticity ratio; size ratio of SW elastographic-to-B-mode lesion). SW elastography measurements were correlated with histopathology of core or surgical biopsy diagnosis.
Results: Final analysis comprised of 92 benign and 74 malignant lesions. The maximum stiffness (Emax) with a cut-off point based on ROC curve of 58.0 kPa provided sensitivity of 90.0%, specificity of 91.3%, positive predictive value of 97.3%, negative predictive value of 91.3% and accuracy of 94%. Applying a cut-off point of 42.0 kPa for SW elastographic mean stiffness (Emean), generated sensitivity of 86.7%, specificity of 97.6%. For SW elastographic ratio (E ratio), the value of 2.2 was found to be optimal, yielding sensitivity of 72% and specificity of 97%.
Conclusion: Shearwave elastography provides highly specific and sensitive quantitative values which is beneficial in the characterisation of breast lesions. Our results showed that Emax is the most accurate parameter for differentiating benign from malignant lesions.

B-0074 10:48

Can we reduce the number of MR-guided biopsies? Application of an algorithm that increases specificity

P.A.T. Baltzer, K. Pinker-Domenig, M. Bernathova, T.H. Helbich; *Vienna/AT*

Purpose: MR-guided biopsy is a useful but expensive technique which is routinely performed on suspicious breast lesions which are apparent only on MRI. Our aim was to apply a classification algorithm assess its efficacy in predicting benign and malignant disease in lesions.
Methods and Materials: This IRB-approved retrospective study investigated 385 consecutive patients (mean age 51.6, SD 12.8) undergoing MR-guided vacuum biopsy of suspicious (BI-RADS 4) breast lesions only visible on MRI. An experienced radiologist blinded to histological diagnoses applied a previously published classification algorithm (Eur Radiol 23 (8):2051-60) based on five morphologic and dynamic criteria to all lesions. ROC analysis was performed in order to measure diagnostic performance for lesion differentiation.
Results: Of 399 biopsied lesions, 79 (19.8%) were malignant. The classification algorithm showed an accuracy of 87.2% ($P < 0.001$). 282 of 399 (70.7%) lesions could be classified as benign with a negative predictive value of 94.3% (266/282). In 89 of 399 lesions (22.3%), a benign histopathologic result could be predicted with 100% accuracy. In the remaining 117 of 399 lesions, malignancy could be predicted with a positive predictive value of 36.2-100% (average 53.8%).
Conclusion: Application of a simple classification algorithm proved its diagnostic use when applied to BI-RADs 4 lesions only visible on MRI. According to our results, at least 22.3% of all biopsies could be omitted.

B-0075 10:57

Ultrasound guided HIFU treatment of breast fibroadenoma

M.M. Abehsera[1], J.-N. Gugliemina[1], J.I. Stoinov[2], E. Poncelet[3], N. Laurent[3], L. Boulanger[4], A. Dana[1], C. Tibi[1], R.D. Kovatcheva[2]; [1]*Neuilly/FR*, [2]*Sofia/BG*, [3]*Valenciennes/FR*, [4]*Lille/FR (marc.abehsera@orange.fr)*

Purpose: The objective of our clinical study is to demonstrate the feasibility, the safety and the efficacy of ultrasound-guided HIFU (USg-HIFU) in the treatment of the breast fibroadenoma.
Methods and Materials: To date, 51 breast FA in 42 patients has been treated by HIFU in 4 European sites. Patients mean age was 32 [16-52]. All FAs were confirmed by histology analysis after a core needle biopsy. The HIFU treatment was performed as an outpatient procedure using neurolept analgesia. The mean baseline volume of the FA was 3.89 cc [0.34 - 19.7 cc].To evaluate potential acute effects, the first follow-up examination was performed at 7 days after HIFU, and the next follow-up visits were performed with an Echo Doppler every month from M1 to M6, and from M9 to M24.

Results: The average treatment time was around 1h12 [0h26-2h33]. A 27 years old patient who became pregnant one month after the HIFU treatment, showed a reduction of volume of 73% at M12 despite hormonal impregnation due to pregnancy. One patient reviewed at M 11 had a volume reduction of 93%. The Mean Volume Reduction was up to 77.6 % at M24.
Conclusion: HIFU treatment is a non-invasive method, well tolerated by patients. For all patients, the volume of the FA declined progressively. Preliminary results are encouraging and show that HIFU could be an interesting alternative treatment.

B-0076 11:06

Non-biopsy or follow-up of presumed fibroadenomas in patients under 30 years of age: is it safe? Four years experience in a single unit and review of European practice

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Purpose: In women under 30 years; fibroadenomas (FA) are the commonest BIRADS 3 lesion and breast cancer is infrequent. On the basis of a 9-year audit in 2009, we implemented strict imaging and clinical criteria such that women< 30 with presumed FAs could safely be discharged without needle sampling or follow-up. Four years after protocol implementation, we report on its accuracy, effect on biopsy workload and potential for influencing European practice.
Methods and Materials: All women< 30 attending the breast unit between 1.2.09 and 31.1.13 were retrospectively identified from our clinical database; their management audited and followed up to 31.6.13. In addition, a survey assessing European practice was completed by 32 centres from 19 countries.
Results: 1571 women< 30 attended the breast unit. 6 aged 25-29 (BIRADS≥4) were diagnosed with breast cancer. Of 332 women scored BIRADS3; 266 (84 aged 25-29) met the non-biopsy criteria and were discharged, 66 were outside the criteria and underwent biopsy (54 FAs, 7 phyllodes tumours, 1 cancer). 14 women re-attended with increased lesion size, none biopsied but 5 excised at the patients request. The protocol reduced biopsies by 78% in women≥20 and by 72% in women aged 25-29. No cancers developed in discharged patients, median follow-up 2.3 yrs (range 0.4-4.4). The European survey indicates 29% of respondents routinely sample FAs in women≥20, 55% in women≥25. Of non UK respondents, 84% follow-up FAs regardless of patient age, 65% regardless of biopsy history.
Conclusion: Our non-biopsy protocol appears safe, reduces biopsy workload and justifies a discharge policy.

B-0077 11:15

Sonographically guided biopsy with 14 Gauge vacuum assisted probe: false-negative and underestimation rate

V. Girardi, G. Carbognin; *Brescia/IT (giravero@yahoo.it)*

Purpose: To determine the diagnostic accuracy of US-guided 14-gauge vacuum assisted biopsy for breast lesions.
Methods and Materials: Seven hundred forty-five cases of sonographically core needle biopsies using a 14-gauge vacuum assisted probe were performed consecutively. We assessed the false-negative rate and the underestimation rate. The false-negative rate was defined as pathologically proved cancer for which US-guided biopsy results were benign findings. The underestimation rate was defined as an upgrade of a high-risk lesion (atypical ductal hyperplasia (ADH), lobular carcinoma in situ, intraductal papilloma and papilloma with atypia, radial scar, phyllodes tumor) or ductal carcinoma in situ (DCIS) at US-guided biopsy to malignancy at surgery. The gold standard were surgical examination or stability during clinical and imaging follow-up (> 12 months).
Results: False-negative finding was founded in 1 (1.34‰) of 745 cases and the false-negative rate was 6.71‰ (1 of 149 malignancies). In 3 (3.1%) of 96 high-risk lesions there was upgraded to malignancy at surgical excision (1 invasive lobular carcinoma, 1 DCIS, 1 DCIS with microinvasion). At Vacuum Assisted Biopsy, these lesions were ADH, papillary lesions and papilloma with atypia. In 3 (33.3%) of 9 cases with a DCIS lesion at US-guided 14-gauge VAB, surgical excision showed invasive carcinoma (2 invasive carcinomas, 1 DCIS with microinvasion).
Conclusion: Use of 14-gauge vacuum-assisted demonstrated good accuracy for false-negative findings (1.34‰). Lesion underestimation was more likely when US-guided 14-Gauge Vacuum Assisted Biopsy revealed DCIS (33.3%) rather than high-risk lesion (3.1%).

B-0078 11:24

Vacuum-assisted breast biopsy using computer-aided 3 T-MRI guidance: a preliminary experience

I. Baglio, L. Camera, G. Barbazeni, C. Cavedon, Q. Piubello, S. Montemezzi; *Verona/IT*

Purpose: To test the feasibility of MRI-guided vacuum-assisted breast biopsy for diagnosis of suspicious breast lesions detected at 3.0 Tesla.
Methods and Materials: Between October 2011 and June 2013, 45 suspicious breast lesions detected with a 3.0 T MR scanner underwent a computer-aided MRI-guided (Dynacad) vacuum-assisted biopsy with post-and pillar technique. All lesions biopsied were classified as BI-RADS 4 or 5. A seven-channel breast array coil equipped for biopsy and a dedicated diagnostic workstation were used for the localisation of the target lesion. After calculating the localisation co-ordinates on the dedicated workstation, a MR-compatible needle (11G or 8G) inserted in the coaxial cannula was placed in the planned position. Post-procedure MRI scans were used to confirm the correct localisation of a marker left in the site of the biopsy.
Results: The mean lesion size was 13.5 mm (range: 5-32 mm). On histopathological examination, 13 were malignant (8 DCIS, 1 mixed carcinoma, 1 tubular carcinoma, 1 invasive lobular carcinoma, 2 invasive ductal carcinoma); 9 were high-risk lesions (3 papilloma, 1 LIN 2, 1 LIN, 1 ADH, 2 DIN 1b, 1 radial scar) and 23 were benign lesions. All malignant and high-risk lesions were sent to surgery (wide local excision or mastectomy), benign lesions were sent to follow-up (6-12 months). Examination of surgical specimens confirmed the results of vacuum-assisted biopsy in all malignant lesions.
Conclusion: Our preliminary experience revealed that 3-T MRI-guided vacuum-assisted biopsy is a safe and effective interventional method that enables accurate biopsy of lesions, especially for small lesions.

B-0079 11:33

Is galactography still state of the art in patients with nipple discharge? An online survey among german breast care centers and a review of the literature

K. Scheurlen, A. Schnitzer, J. Krammer, C. Kaiser, S.O. Schönberg, K. Wasser; *Mannheim/DE (Klaus.Wasser@umm.de)*

Purpose: Since methods such as high-resolution ultrasound (US) and MR-Mammography (MRM) have been established in modern breast imaging the mandatory usage of galactography in patients with nipple discharge is worth questioning.
Methods and Materials: An anonymous online survey was carried out nationwide, opened to 342 radiologic units of certified German centers. 2) A literature search was performed in PubMed and Cochrane for studies reporting on the diagnostic value of galactography, US and MRM.
Results: 1) 177 units (52%) participated. 13% generally do not provide galactographies. 57% conduct a maximum of 5-10 galactographies per year, 18% 11-20, 8% 21-50 and 5% 51-100. Only 4% use galactography initially. 85% give fist priority to US, then followed by galactography (53%) or MRM (32%) in a stepwise diagnosis. 2) A total of 19 studies were found, 14 with results on galactography, 10 on ultrasoundand 5 on MRM. Almost all studies are retrospective. Due to a very variable number of cases and differing inclusion criteria the studies are only comparable to a limited extent and the results on the diagnostic values show a very wide range.
Conclusion: Today galactography is a rarely used method for the vast majority among german breast care centers. Thus, galactography is no longer seen as state of the art within a modern multimodal imaging concept. Furthermore, there is no evidence in the literature for a mandatory usage of galactography. Overall, galactography, US and MRM show a weak evidence and the superiority of one method cannot be derived from the literature.

B-0080 11:42

Fast migration of breast biopsy marker placement during stereotactic core needle biopsy

K. Buch, M.M. Qureshi, A. Jain, A.E. Hirsch, C. Jaffe, D. Georgian-Smith, N. Hines, N.B. Bloch; *Boston, MA/US (karen.buch@bmc.org)*

Purpose: The accurate placement of stereotactic biopsy clips is not only important for localising breast lesions undergoing surgical excision, but also defining the biopsy sites on subsequent mammographic follow-up in lesions not requiring excision. The purpose of this study was to examine marker migration on follow-up biopsy mammograms.
Methods and Materials: A total of 275 SecurMark (Hologic, Bedford, MA) stereotactic biopsy clips were placed in 265 patients undergoing uncomplicated stereotactic biopsies using a 9-gauge vacuum-assisted device from August 2010 to July 2013. Follow-up mammograms on lumpectomy specimens that confirmed marker placement were used to measure the amount of marker migration. Patients with a marker migration of greater than 1 cm were

recorded. Descriptive statistics were calculated and comparisons between two groups were made with the unpaired t-test
Results: Of the 275 stereotactic biopsy clips, 35 (12.7%) clips had migrated at least 1 cm from the intended biopsy cavity. The range of marker migration was 1-6 cm with a mean (± standard deviation) marker migration of 2.40 ± 1.25 cm. Of the 35 migrated biopsy markers, 9 (25.7%) had a migration of 3.5 cm or greater. There was no difference in the amount of migration in the right (2.25 ± 1.02 cm) versus left (2.53 ± 1.42 cm) breast, p=0.513
Conclusion: In this patient cohort, approximately 13% of markers had migrated at least 1 cm from the original biopsy cavity. Marker migration may lead to diminished accuracy of lesion location on radiographic follow-up. Further study is warranted to assess clinical correlations.

10:30 - 12:00 **Room G/H**

Genitourinary

SS 107

Prostate cancer: diagnosis and PIRADS scoring

Moderators:
O. Nikolic; Novi Sad/RS
M.M. Otero-García; Vigo/ES

B-0081 10:30

A novel 68Ga-PSMA PET ligand in patients with biochemical recurrence of prostate cancer using PET/CT and PET/MR imaging
M. Eiber, T. Maurer, A. Beer, M. Souvatzoglou, K. Holzapfel, H.-J. Wester, E.J. Rummeny, M. Schwaiger; *Munich/DE (matthias.eiber@gmx.de)*

Purpose: Prostate-specific membrane antigen (PSMA) is a cell surface protein with high expression in prostate cancer. Recently, Glu-NH-CO-NH-Lys-(Ahx)-[(68)Ga (HBED-CC)] as a new 68Ga-labelled PSMA ligand (68Ga-PMSA) has been developed. Preliminary data show a high and specific uptake prostate cancer. The aim of this study was to investigate the detection rate of 68Ga-PSMA PET/CT and PET/MR imaging patients with a biochemical recurrence.
Methods and Materials: 107 patients (mean age 63.8±7.9) were included in the analysis. Median PSA level was 1.9 ng/ml (range 0.2-45 ng/ml). After injection of 122±17 MBq 68Ga-PSMA, 62 patients underwent contrast-enhanced PET/CT and 45 fully diagnostic PET/MR (including multiparametric prostate MR). Images were reviewed by one nuclear medicine physician and one radiologist. Findings were rated as suspicious or highly suggestive for recurrent prostate cancer.
Results: 92 of 107 (85.9%) patients showed a pathological 68Ga-PSMA uptake. For PET/CT and PET/MR, respectively, the detection rates were 97.6% (40/41) and 100.0% (13/13) for PSA value ≥2 ng/ml, 91.7% (11/12) and 88.9% (8/9) for a PSA value 2-3 ng/ml, 66.6% (6/9) and 56.6% (13/23) for a PSA value < 1 ng/ml. Especially in cases with PSA values < 1 ng/ml, the diagnostic certainty was considerably higher when combining 68Ga-PSMA with multiparametric MR compared to PET/CT. Findings were rated as suspicious vs. highly suggestive in 5/9 vs. 1/9 patients in PET/CT and 2/23 vs. 11/23 patients in PET/MR.
Conclusion: 68Ga-PSMA PET imaging shows a higher of positive findings for patients with recurrent prostate cancer than reported for other tracers especially at low PSA values. PET/MR should be preferred in patients with PSA < 1 ng/ml as multiparametric MR provides additional information increasing the diagnostic certainty.

B-0082 10:39

Non-Gaussian water diffusion kurtosis imaging of prostate cancer
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Purpose: To assess the non-Gaussian water diffusion properties of prostate cancer (PCa) and to determine the diagnostic performance of diffusion kurtosis (DK) model for distinguishing PCa and benign tissues within the peripheral zone (PZ).
Methods and Materials: Nineteen male patients (mean age 68 years, range 51-81 years; mean preoperative PSA level 16.9 ng/ml, range 3.26-115 ng/ml; mean postoperative Gleason score 7, range 6-9) who were pathologically confirmed with prostate carcinoma were enrolled in this study. All patients underwent a prostatic MR protocol on a 3 Tesla MR scanner using a body phased-array coil including T1-weighted imaging, T2-weighted imaging and axial multi-b DW imaging (b-values= 0, 500, 800, 1200, 1500, 2000 sec/mm2). Region of interests (ROIs) were placed on prostate cancer according to pathological findings and benign tissues within PZ for comparison. K, D and ADC values of the ROIs were calculated. Differences between K values of benign PZ and PCa were assessed using paired t-tests. Correlation between parameters D and K in PCa was assessed using Pearson's correlation coefficient.
Results: ADC and D were significantly ($p < 0.001$) lower in PCa (0.79±0.14 μm^2/ms and 1.56±0.23 μm^2/ms, respectively) than in benign PZ (1.23±0.19 μm^2/ms and 2.54±0.24 μm^2/ms, respectively). K was significantly ($p < 0.001$) greater in PCa (0.96±0.20) than in benign PZ (0.59±0.08). The correlation between parameters D and K in PCa was strongly negative (Pearson correlation coefficient = -0.7291; $p < 0.001$).
Conclusion: The DK model appears to provide more parameters for PCa detection. K potentially offers a new metric for assessment of PCa.

B-0083 10:48

MRI features of chronic prostatitis and differentiation from co-existant prostate cancer
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Purpose: Chronic prostatitis is a common histopathologic finding on total prostatectomy specimens; however, imaging features are not well established. Prior reports describe significant overlap in perfusion characteristics between prostate cancer and chronic prostatitis with no difference in perfusion between low-grade cancer and chronic prostatitis. The purpose of this study was to differentiate T2 and enhancement characteristics of chronic prostatitis from cancer using contrast-enhanced MRI (CE-MRI).
Methods and Materials: Following IRB approval, 55 prostate pre-operative CE-MRIs were performed from January 2012 to July 2013 on a 1.5-T scanner in consecutive prostate cancer patients who underwent prostatectomy. MRI findings suggestive of chronic prostatitis were compared to prostatectomy specimens.
Results: Imaging features most suggestive of chronic prostatitis include late-enhancing pseudoseptations with fine, linear striations in a centrifugal pattern irrespective of rapid wash-in within areas with preserved pseudoseptations on dynamic CE-MRI. Of 55 patients, 47 had chronic prostatitis by histopathologic criteria; 50 had MRI findings suggestive of chronic prostatitis with 3 false positives. These findings had a sensitivity of 100%, specificity of 62.5%, PPV of 93.8%, and NPV of 100%.
Conclusion: The key distinction between chronic prostatitis and cancer is the persistent enhancement of fine, centrifugal striations in chronic prostatitis compared to nodular, confluent enhancement without preserved pseudoseptations in cancer. CE-MRI has a high sensitivity, PPV, and NPV for diagnosing coexistent chronic prostatitis in prostate cancer patients. These distinctive imaging features are of high clinical value as they may decrease over-estimation of prostate cancer size and lead to more accurate MRI staging of prostate cancer.

B-0084 10:57

Role of multiparametric magnetic resonance imaging using T2-weighted, diffusion-weighted and 4D perfusion contrast-enhanced MRI in prostate cancer at 3 T
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Purpose: We aim to emphasise the importance of a relatively new multiparametric MR imaging method performed at 3 T using T2-weighted, diffusion-weighted and 4D perfusion dynamic contrast-enhanced MR imaging in diagnosing prostate cancer and detecting biological characteristics of the tumour.
Methods and Materials: Multiparametric MR imaging findings of 21 patients, with no previous treatment, diagnosed to potentially have prostate cancer due to palpable prostatic nodules and/or elevated serum PSA levels (average of 10.26 ng/ml) are evaluated retrospectively. Multiparametric MR imaging sequences were obtained using multi-channel pelvic phase array coil on 3 T Siemens Skyra device. We performed statistical analysis to define the relationship between multiparametric MR imaging parameters and histopathological findings.
Results: 87 foci were positive for prostate cancer with histopathological findings in 12 patients. Pairwise t-test results show that K-trans (ADC) values are significantly higher (lower) in the tumour tissues compared to the normal ones and regression analysis shows a significant relationship (p-value=0.016, significance level=5%) between the ratio of K-trans values of the tumour tissues to that of normal tissues and the Gleason score. A unit increase in this ratio contributes to an average increase of 0.25 in the Gleason score.
Conclusion: We conclude that the T2-weighted morphological imaging method, when used together with functional MR imaging methods such as diffusion-weighted and 4D perfusion dynamic contrast-enhanced MRI, is effective in diagnosing prostate cancer. It also has the potential of providing reliable information regarding biological characteristis of the tumour and the prognosis of the patients.

B-0085 11:06

Prospective impact of the additional use of an endorectal coil for 3 T prostate MRI on image quality and cancer detection rate

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Purpose: To prospectively compare the impact of an additional endorectal receive coil (ERC) on the quality of prostate MR images within the same patients and to determine the corresponding rates for the detection of prostate cancer (PCa).
Methods and Materials: Prior to radical prostatectomy, 41 patients underwent T2- and diffusion-weighted imaging at 3 T using surface coils only (SC) or in combination with an ERC. Two blinded readers (A and B with 70 and 160 prostate readings, respectively) randomly evaluated all image data in two separate sessions. Image quality scores for localisation and staging were rated on a five-point scale (1: very poor, 2: poor, 3: moderate, 4: good, 5: very good). Cancer-suspicious lesions were classified according to their PI-RADS (prostate imaging reporting and data system) score (1-5). Standard of reference was provided by whole-mount histopathologic section analysis.
Results: Mean scores of image quality with ERC were significantly ($p < 0.001$) higher than those without. PI-RADS ≥3 was assigned in 62 (ERC) vs. 49 (SC) cases (A) and 64 vs. 48 (B). Detection rates per lesion were similar for (A), 76% (47/62, ERC) vs. 78% (38/49, SC), and significantly ($p < 0.05$) higher for (B), 88% (56/64) vs. 71% (34/48). Per patient, PCa was correctly identified in 88% (A) vs. 98% (B) of all ERC cases and in 78% (A) vs. 73% (B) without.
Conclusion: Diagnostic performance in terms of the number of cancer-suspicious as well true cancer foci was higher when an additional ERC was used for 3-T prostate MRI.

B-0086 11:15

Prostate cancer diagnosis using MR imaging: does PI-RADS better than conventional methods?

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Purpose: To compare the value of prostate imaging reporting and data system (PI-RADS) with conventional methods on diagnosing the prostate cancer.
Methods and Materials: 166 patients (91 prostate cancers, 75 benign prostatic lesions) with integrated clinical data were enrolled in the study. All patients underwent 3.0 T MR prostate scanning, including T1WI, T2WI, DCE-MRI, DWI and MRS sequences. First, two radiologists who analysed the images in conventional methods, then PI-RADS method was used to analysis T2WI, DCE-MRI, DWI and MRS. The accuracy, sensitivity and specificity were calculated and compared.
Results: The accuracy, sensitivity and specificity using conventional methods on diagnosing prostate cancer were 81.32% (135/166), 82.41% (75/91), 80.00% (60/75), respectively. ROC curve was used to analysis PI-RADS score, area under the curve (AUC) was 0.91, the sensitivity and specificity were 88% and 85% if taking 13 points as threshold. Taking 13 points as threshold, amongst 91 prostatic cancer, 84.62% (77/91) PI-RADS score ≥ 13 points, whilst amongst 75 benign lesions 13.33% (10/75) PI-RADS score ≥ 13 points. The accuracy was 85.54 % (142/166).
Conclusion: Compared with conventional diagnostic methods, the application of PI-RADS can improve the accuracy. Taking PI-RADS =13 points as threshold to identify prostate cancer has higher sensitivity and specificity.

B-0087 11:24

Validation of MRI sequences for PI-RADS scoring based on targeted MR-guided in-bore biopsy

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Purpose: This study retrospectively validates the ESUR scoring system (PI-RADS) in regard to the accuracy of the different MRI sequences at 3 T using MR-guided in-bore prostate biopsies as the reference standard.
Methods and Materials: 492 different lesions in 218 consecutive patients (65.7 ± 7.9 years) with diagnostic 3 T prostate MRI consisting of T2-weighted, diffusion-weighted, and dynamic contrast-enhanced imaging (T2WI, DWI, DCE-MRI) were scored according to the PI-RADS score. Histology of all lesions was obtained by targeted MR-guided in-bore biopsy. Statistical analysis including ROC analysis was completed on all data.
Results: In 159 lesions (98 patients) MR-guided biopsy was positive for tumour (Gleason grade 6 or higher). ROC analysis for each MRI-sequence leads to an area under the ROC curve (AUC) value of 0.683 for T2WI, 0.775 for DWI, and 0.704 for DCE-MRI. For a combination of two sequences, the AUC was 0.789 for T2WI + DWI, and 0.751 for T2WI + PWI. All three MRI-sequences together achieved an AUC value of 0.787 (T2w+DWI+DCE-MRI). For clinical significant prostate cancer (Gleason grade 7b and higher), the AUC value was 0.852 for T2WI + DWI, 0.839 for T2WI + PWI, and 0.72 for T2WI + DWI + DCI-MRI.
Conclusion: The summed PI-RADS score of T2WI, DWI, and DCI-MRI achieves the highest testing accuracy in our patient collective, especially in patients with clinical significant prostate cancer. A usage of only two or less MRI sequences leads to a lower AUC.
G. Antoch: Speaker; Siemens AG, Bayer AG, BTG Röntgen GmbH.

B-0088 11:33

Evaluation of multiparametric MRI PI-RADS scores for the detection of prostate cancer

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Purpose: To evaluate the magnetic resonance prostate imaging-reporting and data system (PI-RADS) for the detection of prostate cancer.
Methods and Materials: 113 lesions of 55 patients who had undergone MRI-guided biopsy of the prostate were retrospectively matched with the corresponding images in previously acquired endorectal multiparametric MR imaging (T2-TSE, DWI, and DCE-MRI) at 1.5 Tesla. Blinded to the results of biopsy two readers evaluated each biopsied lesion according to the PI-RADS scoring system. ROC analysis was performed for statistical analysis.
Results: PI-RADS scores of DCE-MRI revealed a lower AUC (0.76) compared to T2 (0.88; p=0.0619) and DWI (0.93; p=0.0043). Sum scores of T2, DWI, DCE-MRI and of T2 and DWI, only, yielded an AUC of 0.93 and 0.95, respectively. In central gland lesions T2 showed a numerically higher AUC compared to DWI (0.98 and 0.95) whilst in peripheral zone lesions DWI was significantly superior (AUC of 0.93 and 0.73; p=0.041). An approach assigning the PI-RADS score of T2 to central gland lesions and the score of DWI to peripheral zone lesions yielded the highest AUC (0.96) compared to any sequence alone and combined sum scores.
Conclusion: The PI-RADS scoring system for the detection of PCa has a good diagnostic performance. However, scores of DCE-MRI seem to add significant value when evaluated according to the recommended criteria. Assigning the score of T2 to central gland lesions and of DWI to peripheral zone lesions might be sufficient for stratification of patients for further diagnostic workup.
Author Disclosures:
A. Huppertz: Employee; Siemens AG. **B. Hamm:** Board Member; Deutsche Röntgengesellschaft, European Congress of Radiology, European Society of Uroradiology, ESMRMB, European School of Radiology, Deutsche Forschungs-gemeinschaft. Consultant; Bayer Schering Pharma, Toshiba. Other; Abbott, Actelion, Bayer Schering Pharma, Bayer Vital, BRACCO Group, Bristol-Myers Squibb, Charité research organisation GmbH, Deutsche Krebshilfe, Dt. Stiftung für Herz- forschung, Essex Pharma, EU Programmes, Fibrex Medical Inc., Focused Ultrasound Surgery Foundation, Fraunhofer Gesellschaft, Guerbet, INC Research, InSightec Ltd., IPSEN Pharma, Kendle/ MorphoSys AG, Lilly GmbH, Lundbeck GmbH, MeVis Medical Solutions AG, Nexus Oncology, Novartis, Parexel CRO Service, Perceptive, Pfizer GmbH, Philipps, sanofis-aventis S.A, Siemens, Spectranetics GmbH, Terumo Medical Corporation, TNS Healthcare GMbH, Toshiba, UCB Pharma, Wyeth Pharma, Zukunftsfond Berlin (TSB).

B-0089 11:42

ESUR scoring system for prostate cancer detection: how to derive the overall PI-RADS score from different single modality scores?

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Purpose: To evaluate different ways to derive the overall PI-RADS score (1-5) from different single modality scores.
Methods and Materials: Retrospective: The 3 T multiparametric MRI (mpMRI) datasets of 143 consecutive patients were evaluated. Diffusion-weighted imaging, T2-weighted imaging and dynamic contrast-enhanced imaging were performed. 73 patients underwent mpMRI-ultrasound image fusion guided re-biopsy. After scoring these 3 PI-RADS single modalities (1-5), a summation score (3-15) was calculated and 3 different ways to generate an overall PI-RADS score were compared: One approach, which generates the overall PI-RADS from the radiologist's impression after evaluating the single modalities, was compared to different approaches, which derive the overall PI-RADS by division from the summation score.
Results: For calculation of the overall PI-RADS score, a mathematical approach derived from the summation score, as presented by Roethke et al., showed the highest reliability: The threshold of ≥10 (PI-RADS 4) showed high sensitivity (90%) and specificity (62%) for tumour incidence and that of ≥13 (PI-RADS 5) high sensitivity (80%) and specificity (86%) for the presence of high risk disease (gleason ≥4+3). Overall, the single and summation scores correlated well with tumour incidence (AuC of 0.86, 95% CI 0.78 to 0.94) and grading (AuC 0.84, 95% CI 0.68 to 0.99).

Conclusion: A mathematical approach that derives the Overall PI-RADS score (1-5) from the summation score proved to be reliable. Therefore our data suggest a threshold of ≥10 for PI-RADS 4 and ≥13 for PI-RADS 5.

B-0090 11:51

Interobserver agreement of the PI-RADS score for prostate cancer diagnosis on multiparametric MRI

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Purpose: To study the interobserver agreement of the proposed Prostate Imaging Reporting and Data System (PI-RADS) of the ESUR for structured reporting of mp-MRI of the prostate.
Methods and Materials: We conducted an institutional review board-approved single cohort prospective clinical trial. We included 223 men who were suspected of having prostate cancer because of an elevated PSA or abnormal digital rectal examination, without prior transrectal ultrasound-guided biopsies (TRUSGB) of the prostate. All men underwent a 3 T mp-MRI, which included T2-weighted (T2WI), diffusion weighted imaging (DWI), and dynamic contrast enhanced (DCE) MRI. Histology of all lesions was obtained by in-bore MR-guided biopsy followed by standard TRUSGB in MR-positive men, or only standard TRUSGB in MR-negative men. All MRI sequences were co-read independently by 2 investigators. Any discrepancies were resolved by consensus. Inter-observer variability was calculated using percentages of agreement and intraclass correlation coefficients (ICCs) based on a per-patient analysis.
Results: The overall percentage of agreement for the different PI-RADS categories was 75.8% (169/223). When classified to consequence (i.e, whether to perform a biopsy or not; PI-RADS 1-2 vs. PI-RADS 3-5), the percentage of agreement was 91.9% (205/223). Inter-reader agreement was good with an ICC of 0.89 (95% CI, 0.86-0.92). ICCs of the different modalities were moderate, varying from 0.65 (95% CI, 0.56-0.72) for DCE and 0.66 (95% CI, 0.58-0.72) for DWI to 0.67 (95% CI, 0.60-0.74) for T2WI.
Conclusion: The ESUR PI-RADS score shows good to moderate inter-observer agreement and enables standardised evaluation of mp-MRI for prostate cancer detection.

10:30 - 12:00 **Room I/K**

Neuro

SS 111

Novel applications of MRI techniques

Moderators:
I.N. Pronin; Moscow/RU
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B-0091 10:30

First-in-human trial of glutamine PET metabolic imaging: preliminary results in glioma

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Purpose: To study the pharmacokinetics, metabolism, biodistribution and radiation dosimetry of [F-18] 4-L-Fluoroglutamine (*2S, 4R*), a radiolabelled glutamine analogue, in glioma patients.
Methods and Materials: IRB-approved trial protocol and US FDA-approved exploratory IND. All patients provided signed informed consent. Main eligibility criteria: > 21 years; tumour evident on clinical imaging; serum liver and renal indices within specified range; no diabetic medications. Patients fasted 8 hours. ≤222 MBq Fluoroglutamine tracer dose (< 100 µg) injected peripheral IV. PET scans 0, 1, and 3h post-injection. Serial blood sampling for activity and metabolite assays. MIRD formalism and OLINDA software used for dosimetry analyses of PET-derived and blood time-activity data.
Results: 5 glioma patients to-date, including 5 low-grade tumors and 1 transformed high-grade tumour. High-grade glioma evident on Fluoroglutamine PET with rapid, sustained tumour fluoroglutamine concentration. All low-grade glioma PET-negative. Dosimetry favourable. No adverse events due to fluoroglutamine tracer.
Conclusion: This is the first human trial of a glutamine-analogue imaging agent to our knowledge. Our results demonstrate the feasibility of detecting high-grade glioma in human subjects by PET imaging with [F-18] 4-L-Fluoroglutamine (2S, 4R) and encourage testing of Fluoroglutamine PET as a much-needed non-invasive biomarker for distinguishing aggressive high-grade glioma from benign low-grade glioma.

B-0092 10:39

Motor function recovery prediction in patients with acute ischemic stroke using diffusion tensor imaging

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Purpose: Define possibility of diffusion tensor imaging (DTI) for assessing corticospinal tracts (CST) to predict functional outcomes in patients with acute ischemic stroke (IS).
Methods and Materials: 47 patients (19 women, mean age 61) with primary hemispheric IS were examined at 1, 14, 21 days since stroke onset. Fractional anisotropy (FA) of CST was measured on two levels in both hemispheres: posterior limb of internal capsule (PLIC) and cerebral peduncle (CP). Patients' neurological status was assessed using NIHSS and mRS on the 1st and 2 1st days and BI on the 2 1st day.
Results: Patients were divided in two groups: with satisfactory (group A, n=22) and unsatisfactory (group B, n=25) outcomes of motor function recovery by the end of acute period of IS. Following values of CST FA in ipsilateral side in PLIC in group B were achieved: 1st day-0.708, 14th day-0.485, 2 1st day-0.41. Following values of CST FA in ipsilateral side in CP in group B were achieved: 1st day-0.746, 14th day-0.554, 2 1st day-0.473. Thereby, significant decrease of CST FA was determined in group B in PLIC and CP on the 14th and 2 1st days (Mann-Whitney Test $p < 0.05$).
Conclusion: DTI allows to assess changes in conduction tracts beyond the IS zone during acute period of IS. Significant alterations of CST are identified using DTI on the 14th day from onset in patients with unsatisfactory recovery of motor function. Thereby, DTI can be applied for predicting of motor function recovery in patients with acute IS.

B-0093 10:48

MR spectroscopy and FLT-PET: voxel-by-voxel comparison differentiates tumorous tissue in high-grade glioma

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Purpose: Aim of study was to evaluate the diagnostic accuracy of MR spectroscopy (MRS) and 18 F-fluorothymidine-PET (FLT) in high-grade-gliomas.
Methods and Materials: Twelve patients underwent FLT-PET, MRI and MRS on 1.5 T (2D chemical shift imaging (CSI), voxel 10x10 mm, slice thickness 15 mm, matrix 16x16 interpolated to 32x32, covering enhancing part of tumour and healthy tissue, analysed using jSipro with LCModel). Combination of glycerophosphocholine+phosphocholine (GPC+Pch), Creatine, Lactate and N-acetylaspartate (NAA) concentrations were analysed, excluding values with errors over 50%. After FLT-PET to CSI coregistration, mean uptake in each CSI voxel was stored. Tumorous/normal tissue was segmented in contrast-enhanced transversal T1-weighted images, values were normalised to the mean of healthy tissue of each patient. Equality of median values in tumorous/normal tissue was tested with Wilcoxon-Mann-Whitney test, dependency of mean value of FLT on given descriptor was assessed by Spearman correlation coefficient, both on significance level of 0.05.
Results: Comparing tumour and healthy tissue, mean FLT is significantly higher in the tumour (p=3.718e-004). The ratios of NAA over GPC+Pch (Wilcoxon p=4.119e-020/Spearman,rho=-0.36,p=2.133e-008) and Creatine over GPC+PCh (p=7.904e-023/rho=-0.35,p=7.327e-008) significantly differ, being higher in tumour and correlate with FLT. The same results were obtained for NAA/Creatine (p=1.64e-017/rho=0.37,p=1.272e-008). GPC+PCh is higher in tumor tissue (p=4.734e-009). On contrary, GPC+Pch/Lactate ratio is lower in the tumour (p=1.334e-002).
Conclusion: To the best of our knowledge, we present the first voxel-based technique for comparison of FLT-PET and MRS. Both FLT (mean value in the volumes of MRS voxels) and MRS (GPC+Pch/NAA, GPC+Pch/Creatine,Creatine/NAA,GPC+PCh and GPC+PCh/lactate) differentiate tumour and healthy tissue. Supported by IGA MZCR NT11328,NT12094/2011.00023001IKEM,PRVOUK P34.

B-0094 10:57

Microstructural brain tissue damage in metabolic syndrome

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Purpose: We investigate the association between metabolic syndrome risk factors and brain tissue integrity, as assessed by magnetic resonance imaging.
Methods and Materials: From the Leiden Longevity Study, which is a community-based study of long-lived subjects, their offspring and partners thereof, 130 subjects (61 men, mean age 66 years) were included. A metabolic syndrome score was computed by summing the individual number of components according to the Adult Treatment Panel III criteria. We performed linear and logistic regression analysis and used standardised β values to

assess the association between metabolic syndrome and brain macrostructure (brain volume and white matter lesion load, lacunar infarcts, and cerebral microbleeds) and microstructure [mean magnetisation transfer ratio (MTR), MTR histogram peak height, fractional anisotropy, and mean diffusivity (MD)]. Linear and stepwise regression analysis was performed to identify the individual contribution of one metabolic syndrome parameter adjusting for the four other parameters. Models were adjusted for age, gender, and relation to long-lived family.
Results: Brain macrostructure was not associated with metabolic syndrome. In contrast, metabolic syndrome was associated with decreased gray (p=0.001) and white matter peak height (p=0.002) and increased gray matter MD (p=0.01). Serum HDLC (β=0.22, p=0.012), triglycerides (β=-0.25, p=0.002), BMI (β=-0.2, p=0.014), and diastolic blood pressure (β=-0.17, p=0.047 and β=-0.23, p=0.009 for gray and white matter, respectively) were independent factors in these changes in brain microstructure.
Conclusion: In early manifest metabolic syndrome, brain tissue decline can be detected. Serum HDL cholesterol, triglycerides, BMI, and diastolic blood pressure were independent factors in brain tissue integrity.

B-0095 11:06

Experimental study on correlation of histopathological changes and evaluation of MRI in rat spinal injury
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Purpose: To confirm how the impairments of neural functions and histopathological changes in spinal cord are correlated to the FA value and ADC value assessed by MRI.
Methods and Materials: 48 SD rats were randomly assigned to the sham-operated group and the model group. Animals in the model group were given a surgery to expose the spinal cord and an absorbent polyurethane chip was implanted between cervical laminae and cervical vertebral plate, both groups were subdivided into four groups receiving different timing of injury: 4 h, 24 h, 72 h, 1 w, ADC and FA value were measure for data analysis, rats were killed to histological assessment after BBB scoring and MRI scan. Number of motor neurons in the anterior horn of cervical cord in HE-stained sections and the fibre density in the posterior funiculus of cervical cord in LFB-stained sections were measured. The statistical analyses of data were performed by one-way ANOVA and Person correlation analysis.
Results: The correlation analysis demonstrated that the neuron number in the anterior horn of cervical cord was positively correlated to the FA value (0.772) while it was negatively correlated to the ADC value (-0.864); the fibre density in posterior funiculus of cervical cord was positively correlated to the FA value (0.84) while it was negatively correlated to the ADC value (-0.76).
Conclusion: Our experimental data provide valuable evidence for clinical doctors on detecting histopathology and severity of CNS impairments directly using imaging examination.

B-0096 11:15

A possibility of clinically using the unenhanced arterial spin-labeled MR-perfusion in the diagnostics of acute non-haemorrhagic stroke
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Purpose: To determine a possibility of clinically using the unenhanced arterial spin-labelled perfusion MRI (ASL) in the diagnosis of non-haemorrhagic stroke in acute period. To study and describe the MR-semiotics of acute non-haemorrhagic stroke with different genesis according to ASL data as compared to the perfusion CT (PCT) as a reference method. To determine the characteristic signs of damage according to ASL data in acute period.
Methods and Materials: The sample group consisted of the patients with clinically and instrumentally verified diagnosis of non-haemorrhagic ischaemic stroke (n=30), and cerebral venous thrombosis (n=23) in the first day of onset (acute phase). Exclusion criteria: disease duration more than 24 h, history of cerebrovascular disorders, oncopathology. For all patients, native CT, PCT (lopromide-370 mg/ml), MRI in modes T2WI, FLAIR, DWI, ASL have been performed.
Results: Reduced ASL signal in stroke zone corresponding to decrease in CBF, CBV has been observed in 100% cases (mean rASL=0.81±0.17). The perifocal increasing of ASL signal corresponding to increase in CBF, CBV was noted in 30.19% cases in average, and it was characteristic for the venous stroke in 75% with r ASL=1.21±0.19 and for the arterial ischaemic stroke in 25% with r ASL=0.93±0.26.
Conclusion: The ASL MR-method allows to detect not only stroke nucleus but also perifocal high-signal zone as hyperaemia sign more often caused by the cerebral venous thrombosis then arterial ischaemia in acute stage, and this can be used for different genesis (arterial and venous) of stroke.

B-0097 11:24

MOBILE pO2 brain mapping in sub-acute ischaemic stroke
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Purpose: To assess the clinical applicability of brain oxygenation mapping using the MOBILE (mapping of oxygen by imaging lipid enhancement) technique in sub-acute ischaemic stroke patients.
Methods and Materials: 11 sub-acute (2-3 days) ischaemic stroke patients underwent a standardised MR protocol on a clinical 3 T MR system including morphological and diffusion-weighted imaging together with sequences aimed at measuring water relaxation rate R1 (with R1=1/T1), lipids R1 (MOBILE) and R2* (=1/T2*). Regions of interest (ROIs) contouring infarcted areas and mirror contralateral ROIs within unaffected brain tissue were drawn on diffusion images and overlaid on water R1, lipids R1, and R2* mapped images. Comparison of the medians of the water R1, lipids R1 and R2* values within diseased areas versus mirror ROIs was performed using paired t test. Histogram analysis of the ROIs was also performed. Values obtained within patients' unaffected mirror-ROIs were compared to those obtained in 12 healthy volunteers.
Results: Nine infarcts were included into final analysis. Decreased R1 values were recorded within infarcts when compared to unaffected brain tissue, with higher statistical power for lipids R1 (0.408s-1; $p < 0.0001$) than for water R1 (0.154s-1; p=0.027). Decreased values for R2* were recorded within ischaemic brain. All three parameters within unaffected mirror ROIs tightly matched those obtained in healthy volunteers ($p > 0.08$).
Conclusion: Selective analysis of lipids R1 has a better performance than that of water R1 for MR-based pO2 brain mapping using the relaxation effect of molecular oxygen as an endogenous contrast agent.

B-0098 11:33

SWAN (susceptibility-weighted angiography) visualises hypoxia in cerebral veins
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Purpose: To evaluate the influence of hypoxia on the depiction of cerebral veins in the SWAN (susceptibility weighted angiography) sequence.
Methods and Materials: Healthy men (aged 20 - 28) were studied on MRI under normal breathing conditions, short-term - hypoxia (7 minutes before and during the MRI scan) and long - term hypoxia (8.5. hours before and during the MRI scan). Two blinded readers compared the three scans of each participant and graded the SWAN source images and minimum intensity projections (MinIP) according to the size, number and signal intensity of the cerebral veins. Signal intensities (SI) of deep cerebral veins were measured and SI proportions of deep cerebral veins to different parenchymal brain regions were calculated. Continuous pulse oximetry was performed.
Results: Nine subjects were included. In all of them, both readers correctly distinguished the two hypoxia scans from the baseline scan, grading the SWAN images acquired under hypoxic conditions as visualising cerebral veins more pronouncedly. Mean SI values measured in the internal cerebral vein were 860.6 (baseline), 580.1 (short - term hypoxia) and 626.4 (long - term hypoxia), respectively. Overall, all mean SIs and SI proportions were significantly lower in the hypoxia scans. No significant differences between short - term and long - term hypoxia were found on visual inspections and SI measurements. These findings correlated with oxygen saturation measurements.
Conclusion: It was shown under experimental conditions that SWAN is sensitive to oxygen saturation changes in cerebral venous blood. Possible clinical implications of this finding include stroke and tumour imaging.

B-0099 11:42

The DTI tractography challenge for neurosurgical planning
S. Pujol[1], A. Golby[1], G. Gerig[2], W. Wells[1], M. Styner[3], L. Chauvin[1], C. Pierpaoli[4], A. Nabavi[5], R. Kikinis[1]; [1]*Boston, MA/US*, [2]*Salt Lake City, UT/US*, [3]*Chapel Hill, MD/US*, [4]*Bethesda, MD/US*, [5]*Kiel/DE (spujol@bwh.harvard.edu)*

Purpose: The purpose of this paper is to present the Diffusion Tensor Imaging (DTI) Tractography Challenge, an international initiative to provide a standardised evaluation of the performance of tractography algorithms for neurosurgical planning.
Methods and Materials: Twelve tractography teams reconstructed the corticospinal tract from a common set of data acquired on 8 neurosurgical cases with lesions in and near the motor cortex, in the first two editions of the DTI Tractography Challenge workshop at the MICCAI 2011&2012 conferences. The datasets included pre-operative DWI,T1 and T2 volumes with pre-segmented tumor and edema regions. Quantitative evaluation of the variability among tractography results included the degree of bundle overlap and the distance between tracts. A panel of neurosurgeons and DTI experts

assessed the anatomical correctness and depiction of the spatial relationship between the tracts and the tumor using a set of standardised review criteria.
Results: The 476 tractography reconstructions of the corticopsinal tract generated by 21 different tractography methods showed large inter-algorithm variability (average Dice coefficient of overlap: 0.22; average Hausdorff distance between tracts:6.1 mm). The majority of the visualised tracts failed to reach some clinically significant parts of the motor cortex, such as the hand and face motor areas. Improvement in the tractography results from year 1 to year 2 indicate that this collaborative effort is a learning experience for the community
Conclusion: DTI tractography has a unique potential for non-invasive white matter mapping. The DTI Challenge aims to provides a benchmark for the standardised evaluation of tractography methods on neurosurgical data.

B-0100 11:51

Evaluation of the use of chemical shift gradient echo in and opposed phase sequences in 3 T MRI in the detection of H-MRS visible lipids and grading of gliomas
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Purpose: To evaluate the values of 3-Tesla MRI chemical shift gradient echo (GE) in and opposed-phase sequence in discriminating between different grades of brain glioma.
Methods and Materials: A total of 18 patients aged between 15 and 71 years old were enrolled (13 males, 5 females). Nine patients were diagnosed with grade II glioma, three patients were grade III glioma and six patients were grade IV glioblastoma multiforme (GBM). Additional in/opposed-phase and single voxel spectroscopy sequences were done. The signal loss ratios (SLR) were obtained from solid portion of the tumour in the in-phase and opposed-phase. Lipid subtype concentrations were quantified by LC Model.
Results: In clinical application of glioma, the SLR in-oppose phase done on solid component of the tumour of 0.074 allowed classification of low from high grade with 100% sensitivity and specificity, higher than the lipid quantification in MRS which gave highest sensitivity of 66.7% and specificity of 100%.
Conclusion: Chemical shift gradient echo in and opposed phase sequence cause significant signal loss in different grades of gliomas with very high specificity and sensitivity at differentiating low and high grade glioma. This empirical finding provides new discovery that this sequence have the ability to grade the glioma.
Author Disclosures:
N. Ramli: Research/Grant Support; High Impact Research (HIR) Grant (J-20518-73808).

10:30 - 12:00 **Room L/M**

Physics in Radiology

SS 113

Advances in CT technology and applications

Moderators:
C. Leidecker; Forchheim/DE
M. Onu; Bucharest/RO

B-0101 10:30

Fully integrated CT detector technology: evaluation of dose reduction potential
C. Schabel, M. Bongers, S. Mangold, D. Ketelsen, C.D. Claussen, C. Thomas; *Tübingen/DE (christoph.schabel@med.uni-tuebingen.de)*

Purpose: A recently introduced novel, fully integrated design of CT detector technology (IDT) promises low electronic noise levels compared to conventional detector technology (CDT). The purpose was thus to evaluate the increase in efficiency of IDT compared to CDT and its potential radiation dose reduction.
Methods and Materials: Three anthropomorphic phantoms of different diameters (19.8.27.4 and 31.6 cm) were scanned on a dual-source CT scanner (Somatom Definition Flash) shortly before and after IDT installation (Stellar,Siemens,Forchheim,Germany). Phantoms were constructed from different-sized barrels containing water and a centred syringe filled with contrast media of identical dilution. Phantoms were scanned using standard clinical protocols and at additional tube current levels of 40.70,130 and 160% of the standard tube current. Scans were repeated for different tube potentials (80,100 and 140 kV). All other scan parameters were kept constant. Analysis of acquired image data was performed with a custom written MATLAB tool, which facilitated multiple identical noise and contrast measurements within the syringe. Contrast to noise ratios were calculated.
Results: CNR increase measured was up to 24.1% and depending on tube potential (6.1-24.1% for 80 kV,2.7-19.4% for 100 kV and 0.6-12.0% for 140 kV) and phantom size (S 9.2-24.1%;M 0.6-16.8%;L 2.8-23.1%). It was found that extreme combination benefit the most (S & L;40 and 160%) indicating a wider range of good detection. Curve fitting analysis revealed that a potential radiation dose reduction of 1.1-35.4% is possible while receiving equal CNR.
Conclusion: IDT proves to increase CNR up to 24.1% and holds out the prospective to reduce the radiation dose up to 34.1% while acquiring images of comparable quality.

B-0102 10:39

Optimal image-based material decomposition with energy-selective detectors in spectral CT in comparison to dual energy CT (DECT)
S. Faby[1], S. Kuchenbecker[1], D. Simons[1], H.-P. Schlemmer[1], M. Lell[2], M. Kachelrieß[1]; [1]*Heidelberg/DE*, [2]*Erlangen/DE (sebastian.faby@dkfz.de)*

Purpose: To minimise dose and maximise image quality in spectral CT when the number of spectral energy bins B is larger than the number of materials M to decompose into.
Methods and Materials: Energy-selective detectors receive increasing attention in CT since first prototypes are available. For most spectral CT detectors, the number of energy bins B is larger than the number of materials M one desires to separate. M=2 is of interest as it allows to distinguish soft tissue and contrast agent. We propose a new statistics-based method to combine the images of B>M bins into M material images that minimises the image noise and therefore patient dose. For evaluation of our proposed method, a CT system with energy-selective detectors is simulated with B≤8 and compared to DECT. Virtual non-contrast (VNC) imaging is used to quantify our results.
Results: An ideal energy-selective detector with B=4 allows to use 29% lower dose than DECT in the VNC image while significantly improving the iodine overlay image. Simulating a realistic non-ideal detector, however, would require 57% more dose than DECT, which is required to keep the VNC image at the same image quality.
Conclusion: It is shown that an ideal photon-counting detector could lead to a patient dose reduction of up to 29% or more while still achieving a significantly improved iodine image. In a more realistic scenario, however, the current detector technology is not yet able to outperform DECT in the case considered here.
Author Disclosures:
M. Lell: Grant Recipient; Siemens AG. Speaker; Siemens AG.

B-0103 10:48

Visualisation of energy-dependent attenuation properties in vitro and in vivo using polar coordinates in dual-energy computed-tomography data
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Purpose: Dual-energy computed-tomography (DECT) examination with two different x-ray spectra at the same time allows for material decomposition of calcium and iodine. The purpose of the present study was to evaluate a new DECT post-processing approach based on the transformation of dual-energy data into polar coordinates to ease analysis and differentiation between kind of matter and concentration.
Methods and Materials: Given two corresponding DECT (80 kV/140 kV with 1 mm tin filter) images, the attenuation data (ai (U1), ai (U2)) in Hounsfield units of both energies (U1, U2) are transformed to polar coordinates, i.e., the distance, ri, of every data point i to the coordinate origin and its angle, φ_i, to the abscissa is calculated. This approach was evaluated in a phantom containing different substances and in vivo in N=10 rats after application of iodine contrast agent.
Results: For phantom data, evaluation of the parameter map φ(x,y) (x,y: image coordinates) yields mean values of φ of 60.7°±0.3°, 62.9°±0.6°, 66.7°±0.5°, and 71.5°±0.7° for calcium, gadolinium, copper, and iodine. In vivo, mean values of φ were 62.3°±0.4° and 71.5°±0.5° for calcium and iodine.
Conclusion: The evaluated data sets demonstrated clearly different polar-angle ranges for different substances in vitro and in vivo. Polar-coordinate post-processing of DECT data, thus, allows (1) to display the energy dependence of the attenuation coefficient in a function of a single variable, the polar angle φ, (2) to select materials by characteristic polar angles, and (3) to plot the spatial distribution of specific materials in an image with preserved anatomic and morphologic structure (φ maps).

B-0104 10:57

Monochromatic imaging in dual energy CT (DECT): metal artifact reduction with acceptable image quality?

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Purpose: To analyse pseudo-monochromatic DECT imaging with respect to image quality of images with metal implants.
Methods and Materials: Today's clinical DECT systems provide pseudo-monochromatic imaging, a linear combination of the reconstructed low and high kV images. The linear blending factor is typically expressed as a photon energy (in keV) and the method is called monochromatic imaging instead of linear blending. The method is able to reduce metal artifacts under certain patient-specific conditions. True virtual-monochromatic imaging, in contrast, requires rawdata-based processing. We compare pseudo- vs. virtual-monochromatic imaging and quantify image quality of both approaches. Therefore we performed simulations of the Forbild abdomen phantom and measured a semi-anthropomorphic phantom containing iodinated contrast agent and metal inserts in a clinical dual source DECT with 100 kV and 140 kV Sn tube voltage. In each case the reconstructed images were combined linearly to minimise artifacts or to maximise the contrast-to-noise-ratio (CNR).
Results: Pseudo-monochromatic imaging reduces metal artifacts in some cases, at cost of reduced CNR (50% and more). A dataset of the phantom scanned in the clinical DECT system showed a CNR of 4.9 in the low energy image and 3.7 in the high energy image. The pseudo-monochromatic image at the energy E≈139keV yields a CNR of 1.9 while the rawdata-based material decomposition preserves the CNR=4.5 in the low energy image and CNR=3.5 in the high energy image.
Conclusion: The image-based pseudo-monochromatic imaging is a simple but limited method to reduce metal artifacts which goes along with a significant CNR reduction.
Author Disclosures:
M. Lell: Grant Recipient; Siemens AG. Speaker; Siemens AG.

B-0105 11:06

Suppression of the CT beam hardening streak artefact using predictive correction on detector data

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Purpose: To develop an automated program incorporating a predictive artefact correction technique (PACT) to correct for the signal deviations from metal beam hardening artefacts in computed tomography (CT) detector raw data.
Methods and Materials: A thin-slice sequential CT scan was performed on a dosimetry head phantom using a Somatom Sensation 16 scanner to establish a ground truth image. Metal pins were then affixed to either side of the phantom at the three and nine o'clock positions to generate streak artefact detector raw data and a streak image. The program automatically detected the extent of the overlap peaks in the detector raw data causing the artefact. It profiled a correction using adjacent projections so that the peak error could be corrected rather than simply being removed or smoothed by interpolation. The PACT algorithm-modified raw data were then reconstructed on a SYNGO CT reconstruction workstation. This image was then compared against base truth and that produced by commercially available metal artefact reduction (MAR) software.
Results: Qualitative results illustrate superior suppression of streak artefact in images using PACT when compared directly to commercial MAR software. Recovery of voxel data underlying the streak is also demonstrated to be superior with PACT versus MAR when referenced to the original ground truth image.
Conclusion: The experiment demonstrates the feasibility of this predictive artefact correction technique in detecting and correcting beam hardening artefact without recourse to expensive additional options such as iterative reconstruction or dual energy that are not so commonly available in the clinical setting.

B-0106 11:15

Metal artefact removal: single and dual-source CT approaches

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Purpose: The aim of this study was to investigate the feasibility of a single-source CT approach for the reduction of metal artefacts with spectral extrapolation. Additionally, the efficiency was to be compared to established dual-source CT-based methods.
Methods and Materials: A phantom comprising implants and osteosynthetic hardware of variable thickness and alloys of titanium or chromium/moleybdenum/vanadium were scanned on three CT scanners, i.e. a Siemens Flash DSCT (at filtered Sn140 and 100 kVp spectra), an Edge and a Sensation 64 (both at 140, 100 and 80 kVp). Postprocessing was optimised to eliminate metal artefacts by energetic extrapolation as far as possible. For Flash and Edge, the vendor's software was used, and for the Sensation64 data a DICOM-based custom-written software. Artefact removal was graded on a 5-point scale.
Results: Metal artefact removal was effective in titanium prostheses and steel hardware up to 1 cm thickness. The filtered spectra of the Flash scanner provided most effective elimination of artefacts (rating 4.1/5) and could handle a little thicker steel. The effectivity of the Edge with the vendor's software and the Sensation64 with the custom-written software was equivalent (equivalent rating of 3.6/5).
Conclusion: Dual-energy CT is an efficient approach of metal artifact reduction. DSCT with filtered spectra achieves the best results. However, single-source CT with two separate scans represents another efficient approach which provides a significant improvement without exceptional hardware.
Author Disclosures:
T.R.C. Johnson: Patent Holder; Dual Energy CT related patents.
Research/Grant Support; from Siemens and Bayer. Speaker; for Siemens.

B-0107 11:24

Assessment of CT-based thermometry during laser interstitial thermotherapy ablation of swine pancreases

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Purpose: Laser interstitial thermotherapy (LITT) is employed to destroy tumour in organs; its outcome strongly depends on temperature distribution inside tissues.
Methods and Materials: We evaluated temperature influence on the attenuation coefficient obtained by Hunsfield Unit (HU) modifications of CT scan examinations performed during LITT on pancreatic tissue. We performed CT scans examinations of 6 ex vivo swine pancreases while undergoing LITT (Nd: YAG laser, λ=1064 nm, laser energy= 600 J, power= 3 W, treatment time= 200 s) and then we measured density changes placing two regions of interest (ROI) of 0.4 cm^2: the former, localised just upward the applicator, presented a temperature increase and a HU decrease during LITT; the second, at high distance from applicator, shows constant temperature and constant HU during LITT. We have analysed HU variations on 19 consecutive scans with an interval time of 9 seconds.
Results: Tissue density calculated in the first ROI close to the applicator shows a decrease during LITT due to temperature rise from about 57 HU before the treatment to 35 HU when the laser is stopped; it presents a linear dependence with the procedural time (R2=0.8187). In the second ROI positioned distant from the applicator, where temperature rise is negligible, the tissue density does not show significant changes. The HU decreases as a function of temperature, showing a nonlinear trend with a mean thermal sensitivity of −0.50 HU ◦C−1.
Conclusion: Temperature estimation by density variation observed at CT scan could be a suitable mini-invasive tool to choose optimal laser settings to produce a controlled ablated volume.

B-0108 11:33

Urinary stone disease: dose and image quality in low dose CT with and without automatic tube current modulation, with and without iterative reconstruction

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Purpose: To compare dose and image quality (IQ) of a standard low-dose CT vs. a right-dose CT, i.e. with automatic tube current modulation (TCM), in patients with suspected urolithiasis and to assess the value of iterative reconstruction.
Methods and Materials: A CT-examination was performed on 193 patients (Siemens Definition Flash), 103 standard low-dose (120 kV, fixed 45 mAs) and 90 right-dose (120 kV, TCM with 30 mAs reference). Filtered backprojection (FBP) reconstruction was used for both protocols and Sinogram Affirmed Iterative Reconstruction (SAFIRE) for the right-dose only. A first-years resident checked the standard protocol FBP images. Dose and conclusiveness were assessed. Two experienced radiologists re-examined all cases were no stones were found in terms of ureter stones, subjective noise, visibility of the (pelvic) ureter and diagnostic confidence, using respectively a 3 and 4-point scale (1=insufficient; 3/4=excellent). Unpaired t-test, Wilcoxon and Mann-Whiteny test were used for statistical significant differences.
Results: A decrease of 22% in mean effective dose was determined ($p < 0.001$) for the right-dose protocol and conclusiveness was better than for the standard protocol: 96.2% and 78.7% respectively. The right-dose protocol also showed an improved visibility of the pelvic ureter with respect to the standard (median score 2 vs 1, p=0.02). For the other criteria no statistical significant difference was found ($p > 0.05$). SAFIRE did not show improved IQ (p=0.09).

Conclusion: The use of TCM for urolithiasis CT allows for a dose reduction while preserving overall IQ and improving the visibility of the pelvic ureter. SAFIRE seems not to improve IQ.

B-0109 11:42

Comparing the image quality of a mobile flat-panel CT and a multidetector CT: a phantom study

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Purpose: To compare the image quality of a compact mobile flat-panel CT (FPCT) capable of extremity imaging and a multidetector CT (MDCT) in examinations with the same radiation dose.
Methods and Materials: Monte Carlo simulations were used to calculate equivalent dose settings for the FPCT and the MDCT. Simulations were based on and validated by dose measurements. Homogeneity, geometric distortion, artifacts, accuracy of Hounsfield values, contrast and spatial resolution were evaluated in different imaging phantoms. Whitney Mann U Test and Spearman's rho were used for statistical analysis.
Results: Homogeneity reached 2.5% for the FPCT and 0.5% for the MDCT. Hounsfield values were more accurate and contrast to noise ratios (CNRs) were higher for the MDCT than the FPCT. The MDCT depicted more rod inserts than the FPCT. No geometric distortion was detected in either modality. The FPCT was more prone to artifacts around Krischner wires with 2 mm diameter, whereas the MDCT showed a higher amount of artifacts around wires with a diameter of 0.8 mm. Spatial resolution was 1 lp/mm (xy), 1.7 lp/mm (z) for the FPCT and 1 lp/mm (xy), < 1 lp/mm (z) for the MDCT.
Conclusion: We compared a mobile FPCT and a 320-row MDCT by using the same radiation dose for scans. We found the spatial resolution to be higher in the FPCT. Hounsfield units were more accurate, homogeneity and contrast resolution were better in MDCT. The MDCT was also less prone to artifacts from thick Kirschner wires but showed comparably more artifacts around thin wires.
Author Disclosures:
E. Kotter: Board Member; Editorial Board Member Thieme RadBase.

B-0110 11:51

Radiation burden from modern 256-slice CT imaging for suspected pulmonary embolism during pregnancy: Is lung scintigraphy still more dose efficient?

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Purpose: To a) determine normalised data on absorbed radiation dose to maternal radiosensitive organs and embryo/fetus from 256-slice CT pulmonary angiography (CTPA) in pregnant patients suspected for pulmonary embolism, for different maternal sizes and stages of gestation and b) provide reliable maternal effective dose and fetal dose estimates from 256-slice CTPA for comparison with lung scintigraphy.
Methods and Materials: Monte Carlo methods and mathematical anthropomorphic phantoms, generated to simulate adult females of varying body-size at conception and at 3rd, 6th and 9th month of gestation, were used to simulate standard and low-dose 256-slice CTPA examinations. Normalised dose data were derived for exposures at 80, 100 and 120 kV. Slim, average-size and overweight pregnant patients were considered to be scanned with 80 kV-350 mAs, 100 kV-250 mAs and 120 kV-200 mAs, respectively. Mean maternal and fetal doses were determined for 76 pregnant women considered to be subjected to CTPA.
Results: The dose to the embryo/fetus from the standard 120 kV 256-slice CT scan was found to be below 0.5 mGy for all stages of pregnancy. The corresponding values for 80 kV and 100 kV 256-slice CT scans were 2-5 times lower. Maternal effective dose from CTPA was 0.9, 1.5 and 3.2mSv for slim, average-sized and overweight pregnant females, respectively.
Conclusion: The maternal effective dose and the radiation dose to the embryo/fetus from modern 256-slice CTPA studies may be lower than the corresponding typical values for lung scintigraphy. Current results may cancel the rationale of present recommendations regarding the use of lung scintigraphy rather than CTPA in pregnant patients suspected for pulmonary embolism.

10:30 - 12:00 **Room N/O**

Vascular

SS 115

New trends

Moderators:
F. Fanelli; Rome/IT
D.L. Tarnoki; Budapest/HU

B-0111 10:30

Fusion image guidance in endovascular peripheral artery interventions

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Purpose: To evaluate the clinical applicability, geometrical accuracy and value of endovascular guidance by means of live fluoroscopy image fusion with magnetic resonance angiography (MRA) and computed tomography angiography (CTA).
Methods and Materials: Fusion image guidance was evaluated in twenty endovascular peripheral artery interventions (PAI) in seventeen patients. Fifteen patients had received pre-interventional diagnostic MRA and two patients had received CTA. Time for manually performed image co-registration was documeted. Fluoroscopy with MRA/CTA fusion road-map accuracy was evaluated by overlay error in millimetres. Contrast-enhanced angiogram series (CEAS) which were not performed due to fusion guidance and total procedural iodinated contrast media (CM) were recorded. Subjective additional value (AV) of the fusion road-map was scored by the interventional radiologists (0 = no AV; 1 = AV in terms of guidance; 2 = AV in terms of guidance and CM reduction).
Results: Image co-registration was successful in all procedures within approximately five minutes. Overlay error was less than 2 mm in nine procedures and between 2 and 4 mm in eight. Extended patient movements hindered fusion road-mapping in three procedures. Average CM saved per procedure was 9±9 cc (range 0-30 cc) which accounted for on average 17±18% of total procedural CM (mean±standard deviation). AV in terms of guidance (1) was registered in six procedures and in terms of guidance and CM reduction (2) in ten procedures.
Conclusion: Fusion-image guidance is a promising alternative to conventional angiogram road-mapping in routine PAI, potentially reducing CM and consecutively enhancing procedural safety for patients.

B-0112 10:39

Brain structural and haemodinamic changes caused by methcathinone (ephedron) abuse

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Purpose: To assess the brain structural and haemodinamic findings in methcathinone chronic users. This addictive psychoactive substance is derived via the oxidation of ephedrine with potassium permanganate.
Methods and Materials: 41 patients (mean age 41 years) with chronic intravenous use of methcathinone were investigated; All patients underwent brain MRI (1.5 T, 3 T), MR-tractography, MR-angiography and Colour Doppler of extra-intracranial vessels, neurologic and neuropsychological examinations, cerebrovascular reactiviry (CVR) TCD test.
Results: In majority of abusers 32 (78%) extrapiramidal disorders similar to Parkinson`s disease: bradikinesia, postural disturbance, araxia, tremor, muscular distonia was noted. Pseudobulbar syndrome or personal abnormalities was comparatively rare. Two cases of stroke was diagnosted. In 34-year-old male patient, severe dissection and thrombosis of the ICA was marked, and in 41-year-old male, thrombosis of the MCA. MR images revealed T1 hyperintense lesions in 35 (85%) cases, predominantly in globus pallidum (30/74%), substantia nigra (28/68%), nuclei dentatus of cerrebulum (23/55%), anteriot pituitary lobe (16/40%). Clinical picture was correlated with white matter fractional anisotropy. The development of brain changes were signficantly associated with duration of abuse. At MRA moderate to severe vessel irregularity consistent with vasoconstriction and vasodilation was present in 28 (68%) case. TCD revealed reduced blood flow, increased pulsatility index (PI) values and impaired CVR.
Conclusion: MRI demonstrate systematic brain structural deficits in methcathinone abusers. DTI identifies areas of disruption in white matter tracts. Slowed cerebral blood flow velocity with increased pulsatility and impaired CRV in abusers indicate increased cerebrovascular resistance due to vasoconstriction of small cortical vessels.

B-0113 10:48

Respiratory variation of the length of the vena cava: implications for IVC filters

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Purpose: We evaluated the respiratory change of the length and diameter of the vena cava using magnetic resonance imaging (MRI) in relation with transjugular temporary filter migration.
Methods and Materials: Twenty healthy patients were evaluated with MRI; the length and diameter from the right brachiocephalic vein (BCV) to the pararenal inferior vena cava (IVC) were measured.
Results: The lengths of the BCV, superior vena cava (SVC), RA, suprarenal and pararenal IVC during expiration vs. inspiration were 32.7±7.3 mm vs. 43.0 ±8.0 mm, 44.6±9.6 mm vs. 58.5±12.7 mm, 77.8±12.4 mm vs. 98.9±10.0 mm, 104.6±19.1 mm vs. 85.0±14.9 mm, and 49.0±8.7 mm vs. 33.8±9.7 mm respectively. The distances from the BCV to the RA, from BCV to the upper confluence of RV, and from BCV to the lower confluence of RV during expiration vs. inspiration were calculated as 155.2±18.5 mm vs. 200.34 ±20.1 mm, 255.6 ± 27.7 mm vs. 285.6±23.9 mm, and 308.7±31.6 mm vs. 319.1±24.9 mm. The diamaeter of the SVC, the suprarenal IVC, the infrarenal IVC during expiration vs. inspiration were 18.6±2.89 mm vs. 16.4 ±3.0 mm, 15.9±4.6 mm vs. 14.6±5.23 mm, and 14.9±4.8 mm vs.18.0±4.4 mm, respectively. There were statistically significant differences in both vena cava lengths and diameters except the diameter of the suprarenal IVC between expiration and inspiration.
Conclusion: This study demonstrates that the distance from the BCV to the RA, the upper and lower confluences of RV was 4.5 cm, 2.6 cm and 1.0 cm longer at inspiration than at expiration. These respiratory-associated changes of the vena cava length should be considered to prevent transjuglar temporary filter migration.

B-0114 10:57

Study for percutaneous transluminal angioplasty for dysfunctional femoral haemodialysis graft fistula

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Purpose: To analyse the radiologic features of dysfunctional femoral arteriovenous graft and to evaluate various predictors of graft patency rates after percutaneous transluminal angioplasty (PTA).
Methods and Materials: A retrospective analysis was performed to 45 patients who underwent femoral arteriovenous graft placement for haemodialysis and who were referred for PTA for dysfunction between 2005 and 2012. The primary and secondary patency rates after PTA was evaluated. Difference of the primary patency rates according to the presence of diabetes mellitus, graft age from the time of creation to the first intervention (< 12 months or ≥12months), presence of thrombus, shape of graft (U shape or straight shape), anastomosis type of graft (femoral-femoral vs femoral-saphenous), location of stenosis (central vs peripheral), length of stenosis (< 2 cm vs ≥2 cm), degree of stenosis severity (< 70% vs ≥70%), and stent insertion or not were estimated.
Results: A total of 124 PTA were performed. For femoral arteriovenous graft, post-PTA primary and secondary patency rates at 3, 6, and 12 months were 84.8%, 63.6%, 24.2%, and 95.2%, 95.2%, 85.7%, respectively. The average post-PTA primary and secondary patency rates were 13.2 months and 35.7 months, respectively. Metallic stents were inserted in nine of 124 proceducres. There were no significant difference of the primary patency rates for various predictors except between stent insertion group and no insertion group.
Conclusion: PTA is safe and effective treatment modality to treat dysfunctional femoral haemodialysis graft fistula. There was statistically significantly low patency rate in the group of patients by inserting a stent.

B-0115 11:06

Visceral fat accumulation is a risk factor for atherosclerosis of the aorta

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Purpose: To evaluate the relationship between the amount and distribution of abdominal adipose tissue with development of atherosclerotic changes of the aorta.
Methods and Materials: MSCT angiography of the entire aorta was performed in 94 patients (68 men and 26 women; age range 40-85 years). In all patients significant aortic disease was excluded using CT examination. Total, visceral and subcutaneous abdominal fat areas were measured on a single axial CT scan at the level of umbilicus. Aortic diameter and wall thickness of different aortic segments was measured, and atherosclerotic plaques of all aortic segments were semi-quantitatively graded. Correlation analysis between abdominal fat areas and aortic diameters, wall thickness and plaque grades was performed.
Results: We found statistically significant correlation between diameter of all aortic segments and visceral fat area, that was mostly pronounced in the aortic arch ($r=0.42$, $p < 0.05$). Aortic wall thickness was associated with visceral fat area, this relationship was strongest at the level of descending thoracic aorta ($r=0.32$, $p < 0.05$). We also found positive correlation between the visceral fat area and the grade of the largest atherosclerotic plaque of all aortic segments, with the strongest correlation at the level of descending thoracic and abdominal aorta ($rs=0.32$, $p < 0.05$). We did not find any correlation between subcutaneous fat area and aortic wall thickness and atherosclerotic plaque grade.
Conclusion: Visceral fat accumulation accelerates vascular aging, with consequent increase of the risk for future cardiovascular events. The effect of subcutaneous fat tissue on development of aortic atherosclerosis is negligible.

B-0116 11:15

Acute basilar artery occlusion: a safety and efficacy single-centre study

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Purpose: The purpose of this study was to evaluate the safety and efficacy of mechanical thrombectomy in subjects with acute basilar artery occlusion.
Methods and Materials: This retrospective single-center study includes 25 consecutive patients with acute basilar artery occlusion treated within 24 hours after symptoms onset with mechanical thrombectomy. Recanalisation rates, time to treatment, duration of the procedure, hemorrhagic transformation, clinical outcome and mortality rate at 90 days were collected.
Results: The mean age of patients was 61±19 years, and the median prethrombectomy NHISS score was 20 (IQR 11-30). The mean time to treatment was 354.54±212.40 minutes, and the mean endovascular treatment time was 88.22±46.52 minutes measured from needle to final angiogram. Successful recanalisation (TICI 2b/3) was achieved in 22 patients (88.9%). No patients suffered parenchymal hematoma (0%) as a complication of the procedure. A favorable outcome (0-2mRS) at 3 months was observed in 36.4% of the patients (8/22), and the mortality rate was 40.9%(9/22).
Conclusion: Our preliminary results show better results in terms of rate of successful revascularisation (88.9%vs53-65%), funcional outcome (36.4%vs20-24%) and mortality rate (40.9%vs50-56%) than previously published reports for intravenous or intra-arterial thrombolysis. The recanalisation rates (88.9%), functional outcome rates (36.4%)are comparable to those obtained in other reports. However, our mortality rate (40.9%) is slightly higher than other series (21-35.7%), probably because we have missing data in 3 month follow-up. Mechanical thrombectomy in acute basilar artery occlusion is feasible and effectively contributes to a high-rate of recanalisation and improves funcional outcome in patients with ABAO with a low complication rate. These preliminary results must be confirmed in prospective studies.

B-0117 11:24

Endothelial function assessed by ultrasound flow-mediated dilatation in patients with haematologic malignancies subjected to high-dose chemotherapy in the course of haematopoietic stem cell transplantation

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Purpose: Examine endothelial function in patients with haematologic malignancies subjected to high-dose chemotherapy (HSCT) in the course of haematopoietic stem cell transplantation by means of ultrasound flow-mediated dilatation (FMD).
Methods and Materials: The studies were conducted on 43 consecutive patients qualified for HSCT following high-dose chemotherapy based on the current standards. Evaluation of endothelial function by means of ultrasound FMD was conducted in 43 patients with haematological malignancies before HSCT (test A) and after HSCT (test B). We accepted the FMD value ≥ 7% as a norm.
Results: Brachial artery diameter 2 minutes after 5-minute vasoconstriction period, change in brachial artery diameter, and FMD were significantly lower after HSCT as compared to the results obtained before the transplantation ($p < 0.05$). Before HSCT procedure normal FMD was present in 92.11% of patients. After HSCT procedure normal FMD was found significantly less frequently, in 36.84% of patients ($p < 0.05$). The multifactorial step-wise backward regression analysis indicated that administration of fludarabine and cytarabine and higher concentrations of blood creatinine represented risk factors for the impairment of endothelial function expressed as decreased FMD value.
Conclusion: In patients with haematopoietic malignancies treated with HSCT, endothelial function assessed by the ultrasound flow-mediated dilatation was impaired after chemotherapy and stem cells administration.

B-0118 11:33

Assessment of intrarenal flow Doppler parameters in patients before and after pheochromocytoma tumour removal

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Purpose: Pheochromocytoma is a neuroendocrine tumour derived from chromaffin cells in the medulla or adrenal glands. Secretion of norepinephrine or epinephrine may have an effect on the flow of blood in the arterial vessels. The Doppler study was performed to assess potential changes of intrarenal flow presented by resistance indexes.
Methods and Materials: 116 patients treated for pheochromocytoma (56 men, mean age 50.2y ±19.59) were divided into two groups: before (80) and after (35) adrenalectomy, and according to gender. The control group consisted of 121 patients (79 men, mean age 47y±14.82). Doppler examinations were performed with Philips HD11 and HD22 (Philips Andover, MA, USA) equipment using convex transducer 2-4Mhz.The renal size, resistive and pulsality (RI,PI) indexes and acceleration time (At) were measured in intra-lobar arteries of upper and lower parts of the kidney. Analysis of variance (ANOVA) was used when possible, if not possible U test was conducted. Multiple regression analysis was used in tests including quantitative values.
Results: Control and study groups demonstrated a significant correlation ($p < 0.05$) of RI with age and gender of the patient. Conducted tests failed to demonstrate a significant correlation between any of the indicators and the state before and after surgery.
Conclusion: The impact of age on measured values was significantly visible in study and control groups. Adrenalectomy did not significantly change values of RI, PI and At. The Doppler study does not show the influence of catecholamines secretion on renal flow.

B-0119 11:42

Hypoplasia of the vertebral artery: impact on cerebellar blood flow and perfusion characteristics

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Purpose: Hypoplasia of the vertebral artery (VAH) is a common vascular variant and a risk factor for posterior circulation ischemia. The aim of our study was to determine whether VAH leads to a perfusion deficit in the dependent PICA-territory.
Methods and Materials: Vertebral artery diameter was measured in the V4 segment of 934 consecutive patients who underwent multimodal CT due to suspected stroke. VAH was defined by a V4 diameter of up to 2 mm in the CT-angiography. Patients with posterior circulation ischemia, hemorrhagic stroke or other vertebrobasilar pathologies were excluded. The study was designed as a case-control study with a ratio of cases to control patients without VAH of 1:2. Two readers evaluated four different perfusion maps for perfusion deficits in the cerebellum of all patients.
Results: VAH was found in 15.6% with a right sided preponderance (61.6% right VAH). A perfusion deficit in the PICA-territory was present in up to 37.9% of patients with VAH. Time-to-drain (TTD) was the most sensitive map with regard to VAH (sensitivity of TTD 37.9%), followed by mean transit time (35.6%), and cerebral blood flow (34.5%). Cerebral blood volume was not affected in any patient. Cerebellar perfusion deficits were significantly more frequent in patients with VAH than in the control group (7.6%, $p < 0.001$).
Conclusion: VAH can lead to a perfusion deficit in the cerebellum. CT perfusion readers have to be aware of this vascular variant. Its hemodynamic consequences must not be mistaken for acute ischemia.

B-0120 11:51

Evaluation of computational wall stress analysis as an additional characterisation tool of small infrarenal abdominal aortic aneurysms

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Purpose: To evaluate the impact of computational wall stress analysis in computed tomography (CT) of ruptured and not-ruptured small infrarenal abdominal aortic aneurysms (AAA) with a diameter of approximately 55 mm as an additional predictor for rupture.
Methods and Materials: 24 patients (median age 72years) with small infrarenal AAA (mean diameter 52.92±5.2 mm) underwent CT-angiography of the abdomen. Two groups were formed: group1 (9 patients with acute clinical symptoms and ruptured AAA), group2 (15 patients without clinical symptoms and not-ruptured AAA). Using dedicated software (A4clinics VASCOPS) structural analysis of the infrarenal AAA with the finite element method was performed evaluating exterior and luminal diameter, intraluminal thrombus (ILT) thickness, vessel-, luminal- and ILT-volume, peak wall stress (PWS), peak wall rupture risk (PWRR). Additionally the mises-stress and rupture risk-index in the ILT were calculated. Non parametric tests were used for comparison of the two groups.
Results: The maximum exterior diameter, mean total vessel-volume and ILT-thickness did not significantly differ between both groups (group1: 53.6±6.1 mm, 133.3±38.5 cm3, 11.3±9.1 mm; group2: 53.3±5.2 mm, 123.3±52.2 cm^3, 14.9 mm±8.3 mm,($p > 0.11$)). The maximum luminal-diameter and luminal-volume was significantly lower for group2 (group1:47.9±21.9 mm, 70.9±27.4 cm^3; group2:39.2±7.5 mm, 54.6±21.7 cm^3,$p \leq 0.046$), whereas the ILT-volume was significantly higher (group1:42.0±32.1 cm^3,group2:51.9±34.1 cm^3,$p=0.047$). In group1 ILT mean/maximum mises-stress (group1:6.3±2.4kPa/24.5±12.5kPa; group2:5.6±0.4kPa/20.1±5.2kPa) and maximum rupture risk-index (group1:0.41±0.2; group2:0.32±0.08) were significantly higher ($p < 0.041$). Mean PWS and PWRR were lower in group2 (group1:105.9±24.1kPa, 0.24±0.09; group2:101.4±35.3kPa; 0.28±0.07), but not significantly different.
Conclusion: In patients with equal small AAA diameters the ILT-volume and the finite element analysis may serve as additional predictors for risk-stratification.

10:30 - 12:00 **Conf. Room M3**

Interventional Radiology

SS 109

New IR techniques and animal studies

Moderators:
J.M. Lee; Seoul/KR
C. Rosenberg; Greifswald/DE

B-0121 10:30

Early experience of a commercial available robot (Maxio) for CT-guided radiofrequency ablation of liver tumours

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Purpose: To assess the accuracy of needle placement, radiation dose and performance level during robotic-assisted radiofrequency ablation (RFA) of liver tumours using a CT-guidance robotic system.
Methods and Materials: 19 patients were treated with RFA with the assistance of a robotic system (Maxio, Perfint Healthcare, USA). All the procedures were performed under general anaesthesia. Following baseline CT scans, the lesions were identified. The treatment was planned on the Maxio workstation. The accuracy of needle placement, number of readjustments and total radiation dose to each patient were recorded. The performance level was documented for each procedure on a five-point scale (5-1: excellent-poor). The radiation doses and readjustments were compared against 30 RFA patients treated without robotic assistance.
Results: RFA was successfully completed in all the patients. All the lesions were targeted successfully with the guidance of robot. Performance levels were all 5 except in one patient (4). The total radiation dose (CTDIvol) of the robotic-assisted RFA was 411.37+-239.22 mGy, whereas the conventional RFA was 597.10+-437.63 ($p < 0.05$). The fluoroscopic dose (DLP) for the robotic and non-robotic assisted RFA were 596.11+-360.16 mGy.cm and 832.23+-642.80 mGy.cm, respectively ($p < 0.05$). There were no immediate complications noted in either group.
Conclusion: Robotic-assisted RFA improves the accuracy of needle placement, reduce number of needle passes, and significantly reduce the total radiation dose to the patients.
Author Disclosures:
B.J. Abdullah: Equipment Support Recipient; Perfint. Investigator; Publication. Speaker; worshop.

B-0122 10:39

Electromagnetically navigated TIPS procedure: phantom and in vivo evaluation

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Purpose: To evaluate the feasibility of electromagnetic tracking (EMT) transjugular intrahepatic portosystemic shunt (TIPS) placement in a phantom and in vivo setting.
Methods and Materials: A custom-designed TIPS set consisting of a stainless steel stylet, a polypropylene catheter and a stainless steel outer canula was developed. In the tip of both stylet and outer canula, coils were integrated to allow tip detection through an electromagnetic tracking system (Aurora, Northern Digital, Waterloo, Canada). For navigation of the TIPS set, a software prototype was developed that allows visualisation of both the stylet and the outer canula tip position in a previously acquired C-arm CT dataset. The EMT-TIPS procedure was performed in a custom made gel-wax phantom (n=80 trials) and in 8 domestic pigs. Domestic pigs were chosen as an animal model

for challenging TIPS procedures. Time/number of punctures aiming at the portal vein was recorded.
Results: In the phantom setting intervention time to cannulate the portal vein (PV) was 144.0 ± 62.8 s. A mean of 1.2 ± 0.4 punctures was needed for PV cannulation. In the in vivo trials, the TIPS procedure was successfully performed in 5 out of 8 animals. Time for the complete TIPS procedure including prosthesis placement ranged from 40 to 562 minutes with a notable learning curve between the trials.
Conclusion: EMT guidance of TIPS placement proved to be feasible in vitro as well as in vivo. The system holds promise to substantially facilitate challenging TIPS procedures.

B-0123 10:48

Laser-assisted transjugular intrahepatic portosystemic shunt: an experimental study

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Purpose: Transjugular intrahepatic portosystemic shunt (TIPS) is widely applied to prevent rebleeding of esophageal varices or to control refractory ascites. However, it is sometimes difficult to reach portal vein due to rigid hepatic parenchyma, acute angle between hepatic and portal vein, etc. Thus, we introduced a laser probe instead of conventional needles.
Methods and Materials: For normal porcine liver, 15 J/cm (Group A) vs. 150 J/cm (Group B) were directly delivered each ten times by a 980 nm of diode laser probe in a saline bath. Each traverse area of the vaporided holes, coagulation and carbonised tissues was measured in both groups. TIPS was attempted after guidewire negotiation of the hole created by a laser fiber via a Rosche-Uchida set.
Results: In group A, 0.36 ± 0.14 mm^2 of holes with surrounding 3.9 ± 1.6 mm^2 of coagulation were observed, while carbonization was not identified. In group B, 5.5 ± 2.6 mm^2 of carbonization surrounded by 57.8 ± 23.7 mm^2 of coagulation were identified without definite holes. The coagulation areas of group A were significantly ($p < 0.01$) smaller than the ones of group B. After TIPS creation in group A, the coagulation was negligible due to the extended tissue by a stent.
Conclusion: For TIPS creation, low energy laser is feasible to open holes to allow passage of a guidewire instead of conventional needles.

B-0124 10:57

Image-guided periarterial ethanol sympathicolysis for renal denervation: a feasibility study in pigs

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Purpose: The aim of this study was to evaluate the feasibility and efficacy of image-guided periarterial ethanol injection as an alternative to transluminal RF ablation.
Methods and Materials: Unilateral renal periarterial ethanol injection was performed under general anaesthesia in 6 pigs with the contralateral kidney serving as control. All interventions were performed in an open 1.0-T MRI system using real-time multiplanar guidance. The injected volume was 5 ml (95% ethanol labelled marked MR contrast medium) in 2 pigs and 10 ml in 4 pigs. Four weeks post-treatment the pigs underwent MRI including MRA and were killed. Norepinephrine (NE) concentration in the renal parenchyma served as a surrogate parameter to analyse the efficacy of sympathetic denervation. In addition, the renal artery and sympathetic nerves were examined histologically to identify evidence of vascular and neural injury.
Results: In pigs treated with 10 ml ethanol, treatment resulted in neural degeneration. We found a significant reduction of NE concentration in the kidney parenchyma of 53% ($p < 0.02$) compared with the untreated contralateral kidney. In pigs treated with 5 ml ethanol, no significant changes in histology or NE were observed. There was no evidence of renal arterial stenosis in MRI, macroscopy or histology in any pig.
Conclusion: MR-guided periarterial ethanol injection was feasible and efficient for renal sympathetic denervation in a swine model. This technique may be a promising alternative to the catheter-based approach in the treatment of resistant arterial hypertension.

B-0125 11:06

Chemosaturation with percutaneous hepatic perfusions (PHP) of melphalan for hepatic metastases: experience at two European centers

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Purpose: Chemosaturation with percutaneous hepatic perfusion (PHP; Hepatic CHEMOSAT® Delivery System; Delcath Systems Inc, USA) is a minimally invasive, repeatable regional therapy for unresectable hepatic metastases. It uses a system of catheters and filters to isolate hepatic venous blood from the systemic circulation, allowing delivery of high-dose chemotherapy to the hepatic artery. Effluent hepatic venous blood is filtered before returning it to the systemic circulation, thereby reducing exposure to chemotherapy. We describe our experiences with chemosaturation-PHP at 2 European centres.
Methods and Materials: Fourteen patients presented with unresectable hepatic metastases from solid tumours; 13 received 1-3 sessions of chemosaturation-PHP. Melphalan 2.0 (n=1) or 3.0 (n=12) mg/kg was given as a 30-minute infusion into the hepatic artery. Twelve patients were evaluable for tumour response.
Results: One complete (cholangiocarcinoma, n=1) and 6 partial responses (ocular, n=3 or cutaneous melanoma, n=3) were observed; 5 patients had stable disease (ocular melanoma, n=3; breast cancer, n=1; gastric cancer, n=1). Mild to moderate filter-related toxicity (i.e. thrombocytopenia, anaemia) was observed immediately post-procedure. Grade 3/4 melphalan-related pancytopenia developed after 1-2 weeks. All haematological events were managed effectively with transfusions and/or other supportive measures. The new high-efficiency filter showed milder toxicity and faster recovery. In one case, chemosaturation-PHP was abandoned prematurely due to heparin-induced vaginal-bleeding, and one patient died due to retroperitoneal haemorrhage from heparin anti-coagulation.
Conclusion: Chemosaturation-PHP for non-resectable liver metastases is a feasible treatment option when performed by an experienced multi-disciplinary team. It may be a promising regional therapy for patients with no effective treatment options.

B-0127 11:15

Fluoroscopy-guided infiltration for pain reduction in patients with Baastrup disease: clinical experience and results

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Purpose: Baastrup disease refers to degenerative changes of adjacent spinous processes with resultant back pain. Purpose of this study is to assess safety and efficacy of percutaneous, fluoroscopy-guided infiltrations in a consecutive series of patients suffering from Baastrup disease (diagnosed clinically and by imaging findings).
Methods and Materials: During the last 4 years, 55 patients suffering from Baastrup disease (diagnosed clinically and by imaging findings) underwent percutaneous, fluoroscopy-guided infiltration. The position of the needle (22 Gauge spinal needle) was fluoroscopically verified at the level of interspinous ligament. Then a mixture of long acting glucocorticosteroid with local anaesthetic (1.5/1 cc) was injected. A questionnaire with NVS scale helped assessing pain relief degree, life quality and mobility improvement.
Results: In the patients of our study a total of 67 sessions was performed. In 12/55 patients (21.8%) a second infiltration was performed within 7-10 days apart from the first one. Comparing the pain scores prior (mean value 8.18±1.44 NVS units) and after (mean value 0.62±0.93 NVS units) there was a mean decrease of 7.56±1.686 NVS units ($p < 0.001$) on terms of pain reduction, effect upon mobility and life quality. There were no clinically significant complications noted in our study.
Conclusion: Fluoroscopy-guided infiltrations seem to be a feasible, efficacious and safe approach for pain reduction and mobility improvement in patients with Baastrup disease.

B-0128 11:24

Next generation multimodal visible embolisation particles: feasibility study in rabbit and pig animal models

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Purpose: Aim of this study is to produce and test next generation, multimodal visible (X-ray, CT, MRI), embolisation particles with a narrow particle size distribution and synthesised in a new automated process under 100% quality control. Aim of the study is to assess the visibility, manageability and ability to perform controlled, selective embolisation with the particles in vivo.
Methods and Materials: Particles with a diameter of 200 µm and a narrow particle size distribution (± 5% deviation in diameter) are synthesised in a closed-loop automated process. An optimised monomer blend of an iodine containing monomer with an additional cross-linker is polymerised. The monomer blend contains superparamagnetic iron oxide particles. A kidney embolisation model was used. A total of 4 rabbits and 2 pigs were embolised in an X-Ray angiography/Dyna-CT-Setup (Siemens Artis Zeego) under live image control. The animals were examined in clinical MRI (Siemens Magnetom Trio, T1 VIBE, T2* and T2) and CT (Siemens Somatom Definition, 120 kV, 260 mAs, 0.6 mm collimation) scanners directly before and after embolisation.
Results: The particles were visible in CT, MRI and during embolisation in X-Ray/Dyna-CT. A controlled segmental kidney embolisation could be achieved. Periinterventional imaging demonstrated particles in all 3 imaging modalities and in positive correlation to histology which showed proper thrombogenesis.

Conclusion: The automated synthesis process allows the creation of high quality MR, CT and X-Ray visible embolisation particles with a narrow particle size distribution, that will allow, novel, approaches to personalised treatment concepts and therapy monitoring.

B-0129 11:33

Utility of cone beam computed tomography and ablation planning software for monitoring of ultrasound-guided microwave ablation of liver malignancies

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Purpose: To prospectively evaluate the utility of C-arm Cone Beam Computer Tomography (CBCT) and ablation planning software for monitoring of ultrasound-guided microwave ablation (MWA) of liver malignancies and report on feasibility and short-term outcome.
Methods and Materials: Between November 2012 and September 2013 fourteen patients (11 men, 3 women; mean age, 68.5 years) underwent MWA of 15 liver lesions (10 hepatocellular carcinomas, 5 metastatic tumours; mean size 25.3 mm) using a C-arm CBCT. Intra-procedural dual-phase CBCT (arterial and venous) after intravenous contrast administration was performed to determine optimal approach to the lesion (s) using dedicated ablation planning software. MW antennas were positioned under ultrasound guidance and non-enhanced CBCT was performed after deployment. CBCT acquired before and after antenna deployment was registered to evaluate tumour targeting. Diagnostic contrast-enhanced CT was used in case CBCT did not accurately depict lesions. CBCT lesion detection accuracy and number of needle re-positioning on the basis of CBCT and software information were recorded. Clinical success was measured on follow-up contrast-enhanced CT.
Results: All procedures were completed without complications. C-arm CBCT detected 14 of the 15 lesions (93.3%) and registration with diagnostic CT was required in 1 (6.7%). MW antennas were repositioned on the basis of CBCT and software in 10 lesions (76%). Clinical success was achieved in 12 ablations (80%) while 3 (20 %) presented with local recurrence on follow-up.
Conclusion: Monitoring of ultrasound-guided MWA of liver tumours using C-arm CBCT and ablation planning software is feasible and leads to needle re-positioning in the majority of cases.

B-0130 11:42

Irreversible electroporation (IRE) in an acute porcine liver model: effect of previous transarterial embolisation with iodised oil (TAEio) on technical parameters, CT 3D rendering of the electroporation zone, and histology

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Purpose: To evaluate the effect of previous transarterial embolisation with iodised oil (TAEio) on technical parameters, CT 3D rendering of the electroporation zone, and histology after IRE in an acute porcine liver model.
Methods and Materials: In five landrace pigs, two IREs of the right liver (RL) and two IREs of the left liver (LL) were performed with identical system parameters. Before IRE, a selective transarterial embolisation of the left liver was performed with iodised oil until stasis. CT examinations were performed non-enhanced and contrast-enhanced to assess the extent of the electroporation zone. After IRE, animals were killed, and livers harvested. Mean resulting voltage and amperage were assessed during IRE. For CT 3D rendering of the electroporation zone, parameters for size and shape (e.g. short axis, volume, and sphericity index) were analysed. Histological differences were assessed.
Results: Mean resulting voltage and amperage were 2545.3±66.0V and 26.1±1.8 A for RL, and 2537.3±69.0V and 27.7±1.8 A for LL without significant differences. Short axis, volume and sphericity index were 16.5±4.4 mm, 8.6±3.2 cm3 and 1.7±0.3 for RL, and 18.2±3.4 mm, 9.8±3.8 cm3 and 1.7±0.3 for LL without significant differences. For RL and LL, the electroporation zone consisted of severely widened hepatic sinusoids containing numerous erythrocytes, and showed homogeneously apoptosis. For LL, iodised oil could be detected histologically in the center and at the rim of the electroporation zone.
Conclusion: In this acute porcine liver model, there was no adverse effect of previous TAEio on technical parameters, CT 3D rendering of the electroporation zone, and histology after IRE.
Author Disclosures:
C.M. Sommer: Grant Recipient; AngioDynamics Research Grant

10:30 - 12:00 **Board Room A**

Radiographers

SS 114

Conventional radiography: exposure indices, image quality and patient dose

Moderators:
E. Atalar; Ankara/TR
D. Pekarovic; Ljubljana/SI

B-0131 10:30

A European collaborative investigation into the impact of additional copper filtration upon dose and image quality for adult chest examinations

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Purpose: To investigate the impact of additional copper (Cu) filtration upon radiation dose received and image quality during adult chest examinations.
Methods and Materials: Chest examination protocols across Slovenian clinical sites (n=10), detailing: kV, FFD, AEC selection; DR/CR technology, X-ray beam filtration levels were identified. Experimental protocols (n=36) were formulated with referral to Portuguese protocols (n=4) currently employing additional Cu filtration, parameters tested included: 125-150 kVp; 150 cm FFD (AEC:R) and 180 cm FFD (AEC:R+L); 2.5 mmAl with additional filtration levels of 0.1-0.3 mm Cu. A Whole Body PBU-60 phantom was imaged in a postero-anterior chest position. DAP measurements and dose at the thyroid, thorax surface (position of the right breast) and superior breast surface were recorded. Image quality evaluation, incorporating CEC anatomical structure scoring, was performed by radiologists from Slovenia and Portugal (n=6) using Viewdex software, 3MP Barco monitors and ambient lighting levels < 40 lux. VGC analysis compared preset protocols with experimental copper filtration findings.
Results: Application of up to 0.3 mm Cu additional filtration resulted in DAP reductions of 33%. VGC findings identified optimal combinations of 180 cm FFD, 125 kV and 0.2 mm Cu, resulting in a 24% DAP reduction and 150 cm FFD, 145 kV and 0.3 mm Cu recording a 30% DAP decrease. Additional copper filtration reduced dose by up to 57%, 40% and 20% for the thyroid, the superior and inferior breast surfaces respectively.

Conclusion: Reductions in DAP values of up to 33% were identified for increased copper filtration levels, whilst image quality maintenance was quantified using VGC analysis for 180 and 150 cm FFD parameters.

B-0132 10:39

Visual evaluation of target exposure index and deviation index on chest x-ray image using digital radiography system

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Purpose: The purpose of this study is to examine visual evaluation of target exposure index (EIt) and deviation index (DI) specifically for chest X-ray image using digital radiography (DR) system based on the methods of EI and DI defined by IEC and AAPM.
Methods and Materials: At various EI settings, Chest X-ray images with mimic tumours on the back of the chest phantom (KYOTO KAGAKU) were examined with DR system (Philips). For evaluating the EI range under proper image quality, sensory test (Scheffe's paired comparison) was performed by 10 radiological technologists focusing on noise of the mimic tumours. In addition, observation ratio on contrast-detail phantom (KYOTO KAGAKU)-examined various EI values were evaluated by the same radiological technologists.
Results: No significant difference was found under EI range between approximately 400 and 800 by the sensory test. Also EI values of 400 and 800 showed high observation ratio of approximately 95% and 97%, respectively. However, 150 and 1400 EI showed approximately 90% and 98% observation ratio, respectively, were considered under and over exposure, respectively.
Conclusion: Considering EI range obtained by the results of both sensory test and observation ratio on the contrast-detail phantom, it was indicated that proper image quality would be given under EI range between 400 and 800. We conclude that EIt and DI for chest X-ray image using DR system is 550 and -1.5 to +1.5, respectively. In addition, this method is able to adapt for estimating EIt and DI of various parts of X-ray images.
Author Disclosures:
S. Fujimoto: Research/Grant Support; Philips Electronics Japan, Ltd.

B-0133 10:48

The distribution of effective dose and its association with body mass index and dose-area product in abdominal radiographic examinations

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Purpose: To indentify the distribution of effective dose and its association with body mass index (BMI) and dose area product (DAP) in abdominal radiographic examinations.
Methods and Materials: We analysed data from 57 patients undergoing abdominal radiographic examinations in the supine and standing position. The effective dose according to the weighting factor published in ICRP 103 was calculated on the basis of patient information such as height, weight and examination condition, including peak kilovoltage and focus-skin distance, using a Monte Carlo program simulation. The Pearson correlation coefficient and linear regression analysis were used to identify the correlation among effective dose, BMI and DAP.
Results: The mean effective dose was 0.208 mSv and 0.273 mSv in the supine and standing position, respectively. DAP correlated very well with effective dose in the supine ($r=0.973$, $R^2=0.946$, $p=0.000$) and standing position ($r=0.991$, $R^2=0.982$, $p=0.000$), respectively. BMI was also significantly associated with effective does in the supine ($r=0.821$, $R^2=0.675$, $p=0.000$) and standing position ($r=0.806$, $R^2=0.649$, $p=0.000$), respectively. The effective dose tended to increase as BMI and DAP increased.
Conclusion: BMI and DAP have a large influence in effective dose. Therefore, considering effective dose and its association with BMI and DAP, the use of automatic exposure control (AEC) and condition of radiation exposure might be controlled to prevent excessive dosage to patients with high BMI.

B-0134 10:57

10 kVp rule - an anthropomorphic pelvis phantom imaging study using a CR system: impact on image quality and effective dose using AEC and manual mode

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Purpose: This study aims to investigate the influence of tube potential (kVp) variation in relation to perceptual image quality and effective dose for pelvis using automatic exposure control (AEC) and non-AEC in a computed radiography (CR) system.
Methods and Materials: To determine the effects of using AEC and non-AEC by applying the 10 kVp rule in two experiments using an anthropomorphic pelvis phantom. Images were acquired using 10 kVp increments (60-120 kVp) for both experiments. The first experiment, based on seven AEC combinations, produced 49 images. The mean mAs from each kVp increment were used as a baseline for the second experiment producing 35 images. A total of 84 images were produced and a panel of 5 experienced observers participated for the image scoring using the 2 AFC visual grading software. PCXMC software was used to estimate the effective dose.
Results: A decrease in perceptual image quality as the kVp increases was observed both in non-AEC and AEC experiments, however no significant statistical differences ($p > 0.05$) were found. Image quality scores from all observers at 10 kVp increments for all mAs values using non-AEC mode demonstrates a better score up to 90 kVp. Effective dose results show a statistical significant decrease ($p=0.000$) on the 75th quartile from 0.3 mSv at 60 kVp to 0.1 mSv at 120 kVp when applying the 10 kVp rule in non-AEC mode.
Conclusion: No significant reduction in perceptual image quality is observed when increasing kVp whilst a marked and significant effective dose reduction is observed.

B-0135 11:06

Decision making and variation in radiation exposure factor selection by radiographers: an eye-tracking study

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Purpose: The goal of radiographic imaging is to produce a diagnostically useful image while minimising patient radiation dose. This study aimed to review variations in exposure factor selection by radiographers for virtual patients with varying body mass index characteristics. Patient dose is impacted upon by a number of exposure parameters including: kVp, mAs, source to image receptor distance (SID) and anti-scatter grids.
Methods and Materials: Eleven radiographers were asked to assign exposure parameters (kVp; mAs; SID; grid) to forty computer-generated patient images, which represented five BMI categories - underweight; healthy weight; overweight; obese; super-obese. There were four examination categories: antero-posterior (AP) shoulder; AP lumbar; lateral lumbar; AP ward chest. As participants assigned exposures their visual patterns were recorded by a Tobii ® TX300 eye-tracker.
Results: Significant ($p < 0.05$) correlation was found between radiographer age/experience and assignment of mAs for AP shoulder, and lumbar examinations. Greater age/experience correlated with higher mAs for the AP shoulder exam, but with lower values for lumbar examinations. Strong linear correlation between times to first fixations on relevant anatomical areas and kVp/mAs values existed for the AP portable chest examination.
Conclusion: Exposure selection differences related to age/experience highlight inconsistencies in the practice of exposure parameter setting. The reasons for these inconsistencies requires further investigation, and how to address deficiencies in practice requires consideration to optimise safe patient care. Due to the small sample size used, further research into the relationship between visual factors and individual examinations is suggested, following the findings regarding the AP portable chest examination.

B-0136 11:15

An investigation into the impact of lead shielding application on radiographic image quality during lumbar spine examination of obese patients

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Purpose: To determine whether the use of lead shielding (LS) aides in raising image quality levels during lumbar spine examinations of clinically obese patients.
Methods and Materials: Antero-posterior and lateral lumbar-spine radiographs were obtained an anthropomorphic phantom using a kVp range of 80-110 (projection dependant) with LS applied in clinically relevant positions. The phantom was manipulated to achieve 'apple' and 'pear' body shaped body habitus and obesity classes I and II status with application of pre-measured fat packets. Diagnostic Imaging lecturers (n=3), with experience in visual grading analysis (VGA), evaluated the phantom images (n=144), scoring CEC anatomical criteria under controlled ambient lighting viewing conditions of 25-40 lux. Images were displayed using Microsoft power-point on HPL1702 monitors. Statistical analysis of the mean image-quality scores (IQS) was performed to determine if the position of LS and kVp levels influenced resultant radiographic image quality.
Results: Findings indicated no significant impact on the IQS following placement of LS for either body shape variations or obesity classes. Radiographs obtained at the lowest kVp levels received the highest IQS. The use of raised kVp levels from normal presets did not significantly impact upon IQS with the exception of obesity class II images combined with the 'pear' body shape which returned unacceptable VGA findings.
Conclusion: Results indicate that the use of LS did not influence image quality during lumbar spine examinations of the obese phantom models. Optimal image quality was identified following lower kVp application, however, acceptable VGA findings were noted at higher kVp levels.

B-0137 11:24

Image quality and dose analysis in PA chest x-ray: comparison between AEC and manual mode acquisition using the 10 kVp rule

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Purpose: To compare image quality and effective dose when the 10 kVp rule is applied with manual and AEC mode in PA chest X-ray.
Methods and Materials: A total of 68 images (with and without lesions) were acquired of an anthropomorphic chest phantom in a Wolverson Arcoma X-ray unit. The images were evaluated against a reference image using image quality criteria and the 2 alternative forced choice (2 AFC) method by five radiographers. The effective dose was calculated using PCXMC software using the exposure parameters and DAP. The exposure index (lgM) was recorded.
Results: Exposure time decreases considerably when applying the 10 kVp rule in manual mode (50%-28%) compared to AEC mode (36%-23%). Statistical differences for effective dose between several AEC modes were found ($p=0.002$). The effective dose is lower when using only the right AEC ionization chamber. Considering image quality, there are no statistical differences ($p=0.348$) between the different AEC modes for images with no lesions. Using a higher kVp value the lgM values will also increase. The lgM values showed significant statistical differences ($p=0.000$). The image quality scores did not present statistically significant differences ($p=0.043$) for the images with lesions when comparing manual with AEC modes.
Conclusion: In general, the dose is lower in the manual mode. By using the right AEC ionising chamber the effective dose will be the lowest in comparison to other ionising chambers. The use of the 10 kVp rule did not affect the detectability of the lesions.

B-0138 11:33

Dose reduction with PA projection in sacroiliac joint imaging

N. Mekiš; *Ljubljana/SI*

Purpose: To investigate the impact of the PA projection instead of the standard AP projection for sacroiliac joint (SIJ) imaging on the entrance skin dose (ESD), testicular dose and image quality.
Methods and Materials: The study was conducted both, on an anthropomorphic phantom and on 50 male patients, randomly divided into two equal groups. In the first group the SIJ imaging was conducted in the AP projection, whereas in the second group the imaging was conducted in the PA projection. The dose was measured by thermoluminescent dosimeters (TLD) placed at the centre of the image field and on the testicles. Image quality evaluation by using CEC anatomical structure scoring was performed by two radiologists and by three senior radiographers.
Results: When using the PA projection the ESD was reduced from 7.01±3.59 mGy to 5.21±2.57 mGy (p=0.046). The testicular dose was reduced from 27.92±22.07 µGy to 5.64±4.26 µGy ($p < 0.001$). However, the image quality was better in the AP projection (p=0.012).
Conclusion: The results have shown that the ESD and testicular dose in SIJ imaging were lower in PA projection. The image quality performed on patient imaging was lower in PA projection compared to the AP projection, but they could still be used for diagnostics. Therefore the PA projection can be recommended as a method of choice in SIJ imaging.

B-0139 11:42

The effect of breast shielding in panoramic dental imaging

N. Mekiš, N. Dovečar; *Ljubljana/SI*

Purpose: To investigate the impact of lead shielding and its position on breast dose in adult panoramic dental imaging.
Methods and Materials: The study was conducted on an anthropomorphic phantom. The breasts were simulated by breast implants of two different sizes 340 ml and 500 ml. Shield coat and gonadal apron of 0.5 mm lead equivalent were used. The measurements were performed without the use of lead shielding and then with three different positions of shielding: coat for the whole body, gonad apron at the rear of the phantom and gonad apron at the front of the phantom. The dose was measured by EDD-30 placed at the centre of the breast, on the top of the breast and on the top of the lungs.
Results: Using the lead coat shielding reduced the dose at the centre of the right breast (500 ml) from 2.3 µGy to 0.6 µGy and the dose at the centre of left breast (340 ml) from 2 µGy to 0.2 µGy. Dose reduction to the breasts when using gonadal apron at the back of the phantom was on average 1% and an average of 70% was achieved when using it at the front. The dose reduction at the top of the lungs was from 20.5 µGy to 1.6 µGy when the lead coat shielding was used.
Conclusion: Based on the results, we can conclude that the use of coat lead shielding is recommended in the panoramic dental radiography. Despite the low-dose exposure even without shielding, the dose can be further reduced.

B-0140 11:51

Variation of lumbar and pelvis Agfa exposure index in different radiography equipment's

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Purpose: The exposure index (EI) is a useful tool to estimate patient dose based on detector exposure. Agfa systems described EI as logarithmic value (lgM), that corresponds to 1.96 bels in standard Speed Class. The increase of 0.3 in lgM value corresponds to twice of the detected dose. The aim of this study was analyse the Agfa exposure index variation during lumbar and pelvis radiographies.
Methods and Materials: Random anthropomorphic phantom was exposed to lumbar (frontal and lateral view) and pelvis radiographies in ten different centres. Experimental test with exposure parameters according to the recommendations were performed, with and without automatic exposure control (AEC). Unfors Patient Skin Dosimeter (PSD) was used to quantify patient dose and lgM was directly obtained on Agfa workstations.
Results: The lgM mean value with AEC was 1.90 bels with mean patient dose of 75.15µSv and without AEC was 2.06 bels with 68.68µSv. For lumbar frontal and lateral view, with the same exposure parameters, the major lgM value differences were 27% and 33%, respectively. For pelvis the major difference was 29%. Despite lgM variation the PSD obtained values per body region were similar across the centres.
Conclusion: The lgM value revealed a large variation during lumbar and pelvis exposures in different radiography equipment's.

10:30 - 12:00 **Room P**

Computer Applications

SS 105

Trends in reporting, image managment and mobile computing

Moderators:
U.W. Engelmann; Dossenheim/DE
A. Simisker; Tartu/EE

B-0141 10:30

First experience with a novel time-saving method for automatic labelling and curved multiplanar reconstructions for spinal CT

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Purpose: To evaluate a novel method for automatic labeling and curved multiplanar reconstructions of spinal CT and to investigate its potential for time savings and workflow improvement.
Methods and Materials: 77 patients (28 women, 49 men, mean age 65.3±14.4 years) with known spinal disease including degenerative changes of neuroforamina or spinal canal (n=32), disc herniation (n=36) or traumatic vertebral fractures (n=9) were examined using 64-slice MDCT. Required time for automatic labeling and curved multiplanar reconstructions of the examined vertebral column was compared with manual reconstructions. Error rate and additional time for manual error correction during automatic labelling was assessed. Both curved multiplanar reconstructions were assessed by two observers regarding evaluation of anatomical structures.
Results: Correct automatic labelling was achieved in 72 patients (93.5%) with an error rate of 6.5% (n=5), which could be manually corrected in all cases within 16.0±6.6 seconds. Automatic processing of the whole vertebral column was significantly faster ($p < 0.05$) than manual reconstruction (266.3±6.8 seconds vs. 286.7±9.7 seconds, $p < 0.05$). Automatic reconstructions were preferred by both observers in 52 cases (67.5%). In 25 cases (32.5%), both observers stated that both reconstruction methods allowed an equally good evaluation of anatomical structures of the spine. There was no interobserver disagreement.
Conclusion: The presented automatic labelling and curved multiplanar reconstruction method for evaluation of vertebral column CT is time saving and might improve the workflow in routine clinical practice as it rarely requires manual adjustment. Furthermore, automated curved reconstructions were preferred in 2/3 of cases and potentially facilitate evaluation of spinal anatomic structures.
Author Disclosures:
J. Kerl: Speaker; Siemens Healthcare, CT Division. **R.W. Bauer:** Speaker; Siemens Healthcare, CT Division.

B-0142 10:39

Optimising RECIST reading using dedicated software

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Purpose: The purpose of the study was to evaluate the reading time and reliability improvement using dedicated oncology software in comparison with manual determination of RECIST response.
Methods and Materials: 40 patients who underwent a CT-scan follow-up have been evaluated according to RECIST criteria using a standard viewer and dedicated software with 3D elastic target matching and automatic calculation of tumoral response (Myrian® XL-Onco, Intrasense). The medical database contained thoracic and abdominal images. Readings were performed by two operators both with distinct degrees of experience. Reading times, inter and intra-operator reproducibility of measurements and response misclassifications (PD, SD, PR, CR) were evaluated.
Results: Reading times and reproducibility were not affected by the operator degree of experience. In average, the reading time was reduced by 49.7% using dedicated software (mean manual reading time: 106.3 sec., mean software reading time: 50.2 sec., $p < 0.05$). When stratifying results by target localisation, the decrease in reading time was 36.1% for hepatic targets (mean target size: 45.5 mm) and 63.4% for pulmonary targets (mean target size: 18.7 mm). Inter and intra-operator reproducibility of measurements according to each method was identical (r=0.99). Using dedicated software prevented from misclassifications on 10 readings out of 120 (8 were due to calculation errors).

Conclusion: The use of dedicated oncology software optimises RECIST evaluation, decreasing significantly reading times and response misclassifications.
Author Disclosures:
A. René: Employee; Intrasense Employee (CIFRE).

B-0143 10:48

RECIST management at investigator sites: evaluation of a cloud-based quality control of imaging evaluations in clinical trials

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Purpose: Imaging evaluation in oncology depends on readers performances. In order to standardise RECIST (Response Evaluation Criteria in Solid Tumors) application at investigator sites, this study tested a cloud-based quality control of response evaluations.
Methods and Materials: 11 cancer patients with chest CT scans available at 3 time points were retrospectively selected. Images were reviewed following RECIST 1.1 criteria by two oncologists (Japan and Scotland) and one radiologist (France). They used cloud solutions (MEDIAN Technologies) hosted by a data center (Canon, Japan) ensuring centralisation and quality control of both images and evaluations. A quality control of evaluations consisted for the radiologist in checking
oncologists' baseline evaluation and establishing a consensus for the choice of target lesions. The impact of this consensus was analysed by measuring the mean inter-observer agreement on evaluations.
Results: The agreement rate between the oncologists and the radiologist for the target lesions choice increased from 59% (13/22 baselines) to 82% (18/22) before and after consensus. Justifiable differences in images interpretation prevented from having 100%. An agreement rate of 82% (36/44 evaluations) was observed for response evaluations before and after consensus. The rate was higher than in a previous pilot study without consensus (40%, 8/20). The quality control solved all non-conformities to RECIST (18%, 4/22 baselines).
Conclusion: The study shows the feasibility of a cloud-based quality control of imaging evaluations in multi-center international clinical studies that ensured 100% of compliance with RECIST criteria. An improved agreement in the choice of target lesions was accomplished in conformity to RECIST.

B-0144 10:57

Mobile DICOM viewing applications facilitate multicenter radiology

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Purpose: Mobile communication via tablet devices and smartphones has increasingly entered the healthcare sector. Continuous improvements in the resolution of tablet devices have made them interesting for radiological image viewing. However, integrating mobile applications into radiological workflows is difficult since major investments for extending IT infrastructure are often required. Here we introduce an economical approach to easily integrate radiological infrastructures, facilitate multicenter networking and establish a sophisticated base for target-oriented procedures of forensic medicine based on mobile applications.

Methods and Materials: Feasibility of integrating the CT infrastructure of the Institute of Forensic Medicine, University of Heidelberg, and the Department of Radiology, German Cancer Research Center (DKFZ), Heidelberg was evaluated with a forensic-radiological workflow. This included acquiring CT images, radiologists viewing images to generate pre-reports and furthermore forensic pathologists viewing images along with radiologists' pre-reports at autopsy. To view and access images the application MITKpocket, developed by the Department of Medical and Biological Informatics at DKFZ, was used which allows offline image processing on tablet computers.
Results: Inter-department communication in the case of forensic imaging purposes was facilitated. The CT infrastructures were integrated by virtual private network (VPN) while MITKpocket supported radiologists and pathologists to access and process images. Hence no cost-intensive investments to extend modify and maintain the previously existing radiological infrastructures were needed.
Conclusion: A practical approach to integrate mobile radiological applications into multicenter workflows was best achieved by offline capable applications of teleradiology. Even limitations of wireless IT infrastructure could be fully compensated within the forensic-radiological workflow.

B-0145 11:06

DICOM-SandBox, an open communication platform for collaborative research

N. Roduit, T. Strgar, O. Ratib; *Geneva/CH*

Purpose: The goal of our project is to develop a secure portal for exchange of large sets of medical images between professionals. Unlike existing DICOM-based teleradiology systems intended for clinical data, we elected to design an open system that allows researchers to exchange anonymised image data in a decentralised peer-to-peer architecture based on social networking paradigm. This project is an exploratory initiative of the ESR eHealth and informatics subcommittee.
Methods and Materials: The file exchange platform was developed around an Open Source framework called "ownCloud" (www.owncloud.org), allowing universal data and file exchange through web interface or WebDav that enables users to use existing cloud-based storage services though a single portal. The system handles the management of social networks of a community of users supporting notification and data exchange between users or groups. The open "plug-in" architecture allowed us to extend its functionalities with specific features for management and display of DICOM files. Hierarchical storage and thumbnail preview of image series are part of the added features. Special interface modules were developed for seamless integration of existing Open-Source DICOM viewers including OsiriX and Weasis (www.osirixviewer.com). The system relies on existing cloud-storage services such as DropBox and Google drive, allowing each user to use his own storage service.
Results: A prototype system was developed and tested among different academic institutions for exchange and communication of anonymous DICOM files.
Conclusion: The DICOM-SandBox system provides an Open-Source solution for convenient and efficient exchange and communication of DICOM files among academic and research teams.

B-0146 11:15

Comparison of a tablet-PC with a high-resolution display and a dedicated PACS worsktation in emergency MDCT interpretation

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Purpose: To compare a tablet-PC with a high-resolution display (iPad 3) and a dedicated 3D PACS workstation for the interpretation of emergency CT examinations
Methods and Materials: The detectability of early signs of cerebral infarction and subtle pulmonary embolism in 40 CCT and 40 CTPA examinations was scored by three readers using both, a tablet-PC with a high-resolution display (iPad 3, Apple Inc., USA) running a radiology app (Visage Ease, Visage Imaging GmbH, Berlin, Germany) and a 3D PACS workstation (Visage 7.1, Visage Imaging GmbH, Berlin). Diagnostic confidence was evaluated on a 5-point-Likert scale. Statistics included Wilcoxon rangsum test, Spearman's correlation and Cohen's kappa.
Results: For all readers, there was no significant difference in the median score between iPad 3 and PACS for the CCT and the CTPA, respectively ($p > 0.05$). The mean Spearman's correlation coefficients were 0.46 (±0.2) / 0.69 (±0.16) for the comparison between the iPad and the PACS, 0.41 (±0.16) / 0.68 (±0.06) for observer agreement using the iPad and 0.35 (±0.05) / 0.68 (±0.10) for observer agreement using the PACS for CCT and CTPA, respectively. Mean kappa values were 0.52 (±0.17) / 0.67 (±0.19) for the comparison between iPad and PACS, 0.33 (±0.16) / 0.69 (±0.08) for observer agreement using the iPad and 0.32 (±0.16) / 0.60 (±0.14) for observer agreement using PACS. The differences were not considered statistically significant ($p > 0.05$)
Conclusion: There is no significant difference from interobserver agreement in the interpretation of typical emergency CT examinations between the iPad 3 and a dedicated PACS workstation.
Author Disclosures:
T. Rodt: Research/Grant Support; Visage Imaging. **F. Wacker:** Research/Grant Support; Visage Imaging, Siemens Healthcare. **C. von Falck:** Research/Grant Support; Visage Imaging, Siemens Healthcare.

B-0147 11:24

Quality control in radiology reporting: experience in a private setting

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Purpose: The aim of this study is to set up quality criteria of our radiology reports, to present a quality control model for reporting, to identify the most frequent errors in our reporting and to suggest corrective actions of improvement.
Methods and Materials: 32 quality criteria of radiology reports have been defined and adapted by the radiologists in a group of private clinics covering the main imaging modalities. Five pairs of radiologists evaluated 250 structured anonymous reports independently. A consensual review and discussion was performed for all reports foor both analytical and educational purpose. A scoring system of the various criteria was made to depict the weak points in the reports. We only studied the reports, not the imaging details.
Results: We identified our most frequent reporting errors (global and individual analysis). The most frequent reporting errors were: wrong study title, unclear indication, vague conclusion and not answering the clinician's question. We set up a pertinent checklist of quality criteria of our structured reports. We present typical examples of conformity, consistency and the most frequent errors in reporting. This project enhanced the awareness of radiologists about their most frequent reporting errors. Peer review was appreciated by radiologists as it helps to share knowledge.
Conclusion: Improvement of the quality of the report depends mainly on the awareness and involvement of radiologists to apply quality standards. Quality improvement of structured reporting must be a continuous process of correction and implementation (continuous quality improvement principle).

B-0148 11:33

iPad-based primary 2D reading of CT angiography examinations of patients with suspected gastrointestinal bleeding: performance comparison with a conventional workstation

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Purpose: To evaluate the effectiveness of the iPad for 2D reading of CT angiography studies performed for suspected acute gastrointestinal bleeding.
Methods and Materials: Twenty-five CT angiography (CTA) examinations of patients with suspected acute gastrointestinal bleeding either confirmed (20/25, 80%) or ruled out (5/25, 20%) by digital subtraction angiography (DSA) were retrospectively reviewed by four independent readers. Two readers evaluated source axial CTA images on a commercial workstation (Advantage Windows 4.5, General Electric, Milwaukee, WI), whereas the others assessed the same images on an iPad with Retina Display™ (64GB model, Apple Inc, Cupertino, CA). All CTA images had been wirelessly transferred on the iPad in JPEG lossless format using the Bonjour™ protocol. The time needed to complete reading of every CTA examination on the iPad and the workstation, detection of arterial blush, and suspected bleeding arteries as assessed on both devices were recorded.
Results: The time needed to complete reading of every CTA study was significantly shorter on the iPad than on the workstation (171±84 vs 227±91 seconds, respectively; $p < 0.002$). Sensitivity and specificity for arterial blush detection were 85% and 60% for the workstation and 90% and 80% for the iPad, respectively. Inter-reader agreement for workstations and iPads was good (Cohen k=0.70) and very good (k=0.88), respectively. Agreement of workstation and iPad vs DSA on bleeding arteries was very good (k=0.82 and 0.89, respectively).
Conclusion: iPad-based preliminary 2D reading of CT angiography studies of patients with suspected acute gastrointestinal bleeding is feasible and significantly faster compared with a conventional workstation.

B-0149 11:42

Adaptive support for PACS interface customization

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Purpose: To evaluate the usefulness of adaptive customization support in the Picture Archiving and Communication System (PACS) user interface.
Methods and Materials: Adaptive support was given in the form of customization suggestions, generated based on behavioural user data, which participants could choose to accept or ignore. Twelve radiologists worked with the standard adaptable version of the PACS for six weeks, during which their actions on the PACS interface were logged. Based on these logging data, customization suggestions were generated for each specific participant. Half of the participants received these suggestions and half did not. After the suggestions, logging continued for another six weeks. Participants' customization behaviour and performance, measured as the average time needed to review a radiography study, were compared between the groups. Subjective responses to the customization process were also measured.
Results: Participants accepted most of the customization suggestions and all participants indicated that the suggestions were useful. Participants who received customization suggestions used the customizable elements of the PACS's interface more frequently than participants who did not receive the suggestions. There were no effects in the performance data, possibly because the performance measure we used was not sensitive enough. Subjective responses did show that participants judged the adaptive support as improving their efficiency.
Conclusion: Adaptive customization support is a valuable addition to the standard adaptable PACS interface, because it allows radiologists to customize their interface more effectively and can thereby increase the efficiency with which they interact with the PACS.

B-0150 11:51

Web-based interactive 3D visualisation of CT image data on tablet computers for educational purposes

R. Unterhinninghofen[1], S. Doll[2], F. Rengier[2], R. Talanow[2], J. Kirsch[2], R. Dillmann[1], H.-U. Kauczor[2], F.L. Giesel[2]; [1]*Karlsruhe/DE*, [2]*Heidelberg/DE (roland.unterhinninghofen@kit.edu)*

Purpose: Volume rendering of CT image data is a 3D visualisation technique well known from commercial workstations where it supports diagnostics and therapy planning. In order to render these appealing views available for educational purposes, we developed dedicated software solution AnatomyMap.
Methods and Materials: Since tablet computers usually do not provide sufficient computational power to render 3D visualisation at interactive rates, we created a client-server solution based on in-house developed software framework MEDIFRAME. A high-performance server performs rendering on demand and streams the resulting views via internet to the client, e.g. a tablet computer. Users find a common display with 2D and 3D views of the CT data that may be scrolled, rotated, zoomed, or panned interactively. For educational purposes labels may be displayed for selected anatomical structures. Also, for each structure an appropriate view is predefined that can be reached in an animated flight. In exercise mode users assign names to empty labels using drag and drop.
Results: 30 CT datasets of different body parts, including head, neck, thorax, abdomen, and extremities were manually labelled with (normal) anatomical structures. Additionally, 12 CT datasets were labelled with specific pathological structures. The software has been experimentally used in an online course with 10 users located at different places in Europe. All users were able to run the web-based software and perform the required exercises. Depending on individual internet bandwidth overall experience with interactive rendering was good.
Conclusion: AnatomyMap has been found a practicable tool and motivating extension to the anatomical atlas.

14:00 - 15:30 **Room B**

Abdominal Viscera

SS 201a

Advanced imaging of pancreas

Moderators:
L. Grzycka-Kowalczyk; Lublin/PL
C. Triantopoulou; Athens/GR

B-0151 14:00

Incidental hypervascular pancreatic lesions: prevalence and imaging features on MDCT

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Purpose: To assess frequency of hypervascular pancreatic lesions (HPL) incidentally detected on multidetector CT (MDCT) and to evaluate morphological features that can allow their characterisation.
Methods and Materials: From August 2012 to February 2013, we retrospectively reviewed on the Institution's electronic database 3827 consecutively contrast-enhanced abdominal MDCT performed both on a 256 (iCT, Philips) or 16-row CT scanner (Brilliance, Philips). The inclusion criterion was the incidental detection of hypervascular pancreatic lesions in patients with no symptoms related to the lesion itself. We evaluated several CT findings including lesion location, size, morphology, presence of calcification and vascular pattern. Then, we correlated imaging findings with available clinical data.
Results: We detected 28 solid HPL (prevalence 0.4%) in 14 patients (9 male, 5 female; age range 67-83, mean 76). Sizes ranged from 3 to 58 mm, (mean 13 mm; median 9 mm); most common site of the lesion was the pancreatic tail

(11/28). A final diagnosis was reached in all cases by medical history or histopathological analysis: pancreatic neuroendocrine tumour (11/28), intrapancreatic accessory spleen (1/28), and renal cell tumour (RCC) metastases (16/28). Main pancreatic duct obstruction without parenchymal atrophy was found in 1 patient (RCC lesion). Symptoms were present in 2/14 (14%) patients; reported symptoms were SIADH (1 case) and abdominal pain (1 case). Dimensional growth during follow-up was observed in 21/28 cases (16/21 were RCC multiple pancreatic metastases).
Conclusion: Incidental HPL are uncommon findings on MDCT. When multiple lesions are present, MEN I syndrome and presence of RCC should be considered.

B-0152 14:09

Diagnostic accuracy of 256-detector row computed tomography in detection and characterisation of incidental pancreatic cystic lesions: a large population series

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Purpose: To assess the diagnostic value of 256-detector row MDCT in characterisation of incidentally detected pancreatic cystic lesions in a large population of patients.
Methods and Materials: We retrospectively reviewed 6389 examinations performed on a 256-row detector scanner (iCT, Philips, 120 kV, automated current modulation) between January 2011 and February 2013 for incidental detection of pancreatic cysts. 192 patients (99 females, 93 males; age range 31-90) were enrolled. Images were evaluated by two radiologists referring to standardised morphologic features and predictive signs of malignancy: lesion's location, multifocality, size, communication with main pancreatic duct (MPD), MPD size, inner septa, wall thickening and mural enhancing nodules.
Results: We evaluated 292 cysts in 192 patients (prevalence 2.05%). Diagnosis was established by histopathology or by imaging analysis: solitary branch type IPMN (48.4%), multifocal branch-type IPMN (14.1%), main type IPMN (13%), mixed IPMN (10.4%), pseudocysts (2.6%), mucinous (7.3%) and serous cystoadenoma (3.7%), metastases (0.5%). Solitary cysts were found in 145/192 (75.5%), two lesions in 27/192 (14.1%) and more than two in 20/192 patients (10.4%). Size ranged from 3 to 145 mm (mean 15 mm); lesions were mostly located in pancreatic body (87/292; 29.8%). We detected septa in 52/292 lesions, wall thickening > 2 mm in 13/292, wall enhancement in 15/292, mural enhancing nodules in 12/292, communication with ductal system in 25/292 and MPD dilatation in 10/292.
Conclusion: MDCT provide important diagnostic features for characterisation of pancreatic cystic lesions, incidentally discovered with increased frequency due to the widespread use of cross-sectional imaging.

B-0153 14:18

Effect of incidental pancreatic cystic lesions on all-cause mortality and incidence of pancreatic adenocarcinoma and ductal carcinoma

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Purpose: To assess effect of incidental pancreatic cysts (IPC) on all-cause mortality and incidence of pancreatic adenocarcinoma (AdenoCA) and pancreatic ductal carcinoma (DCA).
Methods and Materials: Cyst cohort included cases with CT/MR reports done between 11/1/01 and 11/1/11 describing IPC. No-cyst cohort was frequency-matched on age decade, modality and year of initial study from pool of patients without reported IPC. Cases diagnosed with pancreatic cancer within 5 years of initial CT/MR were excluded. Charlson 2 scores within 2 months of index date were recorded. 10-year cumulative mortality and 10-year cumulative incidence of AdenoCA/ DCA were compared between the cohorts. Cox Hazard models were constructed with all-cause mortality and incidence of AdenoCA/DCA as outcome events, adjusting for age, sex, imaging modality and Charlson 2 score.
Results: There were 1,337 cases in Cyst cohort and 3,993 cases in No-cyst cohort with mean age of 70.6 (±15.4) and 70.0 (±15.6) years, respectively (p=0.304). 10-year cumulative all-cause mortality was 13.0% (95% CI 10.2-16.5) in Cyst cohort and 11.7% (95% CI 10.1-13.4) in No-cyst cohort. 10-year cumulative incidences of AdenoCA/DCA were 1.6% (95% CI 0.8-3.3) in Cyst cohort and 0.3% (95% CI 0.1-0.6) in No-cyst cohort (p < 0.001). For all-cause mortality, IPC had HR of 1.74 (95%CI 1.14-2.64) in subjects < 70 years and HR of 0.9 (95% CI 0.69-1.18) in those ≥70 years. For AdenoCA/DCA, IPC had HR of 4.22 (95%CI 1.65-10.8).
Conclusion: Incidental pancreatic cysts on CT/MR are associated with 4.2 times higher risk of pancreatic AdenoCA/DCA and with 1.7 times higher all-cause mortality in subjects < 70 years.

B-0154 14:27

Arterial hypervascular solid-looking serous cystadenoma of the pancreas: differential diagnosis with neuroendocrine tumours

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Purpose: To describe imaging findings of arterial hypervascular solid-looking serous cystadenoma (SCN) of the pancreas on CT and MR and to find imaging features which differentiate it from neuroendocrine tumour (NET).
Methods and Materials: Among 211 patients with surgically proven SCNs, we retrospectively identified 15 arterial hypervascular solid-looking SCNs. We randomly chose size-matched 30 NETs from 80 pancreatic NETs. Two radiologists evaluated available CT and MR images in consensus. On CT, the reviewers assessed the size, location, shape, margin, CT attenuation and enhancement grade relative to the adjacent pancreatic parenchyma on the non-enhanced and dynamic phases. On MR, signal intensity characteristics of the tumour on T1-, T2-weighted images and ADC maps were evaluated. These features and measurements were compared using the Fisher exact test and the Mann-whitney test.
Results: The frequency of arterial hypervascular solid-looking SCNs was 5.1% amongst all SCNs. The mean size was 25.8 mm (range, 8.4-80 mm). CT findings were similar between the two tumours: location, shape, margin, and enhancement patterns the dynamic phases. However, SCNs were significantly hypodense on non-contrast CT images than NETs (P=.03). They differed significantly on MR: bright signal intensity on T2-weighted images were more common in SCNs than NETs (P=01). All SCNs showed restricted diffusion on ADC map, while none of NETs did (P <.01).
Conclusion: It is often difficult to differentiate arterial hypervascular solid-looking SCNs from NETs, since they share similar imaging features. Hypoattenuation on non-contrast CT images, bright signal intensity on T2-weighted MR images, and diffusion restriction can facilitate the differentiation.

B-0155 14:36

Added value of diffusion-weighted imaging to conventional MR imaging in the preoperative detection of small pancreatic carcinoma

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Purpose: To evaluate the benefit of adding diffusion-weighted (DW) imaging into the conventional MR imaging in the preoperative detection of small pancreatic carcinoma (≤ 2.0 cm).
Methods and Materials: The study included 83 patients (56 men, 27 women) with surgically confirmed pancreatic adenocarcinoma (n= 53 ≤ 2.0 cm; n=30 2.1-3.0 cm) and 12 patients with histologically proven focal pancreatitis who underwent gadoxetic acid-enhanced MR imaging and DW imaging between August 2010 and November 2012. Two observers independently reviewed two image sets: 1) conventional MR imaging set including MR cholangiopancreatography and 2) combined image set including DW imaging to evaluate the circumferential tumour conspicuity using receiver operating characteristic curve analysis. Contrast ratios of each tumour and proximal or distal pancreatic parenchyma to tumour on T1- and T2-weighted image, arterial and portal phase, and b-800 DW imaging were also calculated.
Results: On b-800 DW imaging, most tumours were completely (n=32, 38.6%) or partially (n= 59.0%) delineated. For each observer, A_Z values for tumour detection were 0.852 and 0.884 for the conventional image set, and 0.975 and 0.978 for the combined set (*P*=0.003; 0.04). For detecting 53 tumours (≤ 2.0 cm), the combined set (96.2%[51/53]; 94.3%[50/53]) yielded better sensitivity than the conventional image set (67.9%[36/53]; 71.7%[38/53]) (*P*=0.001; *P*=0.008), although no significant difference was found between the two image sets for detecting tumour > 2.0 cm (*P*> 0.05). Contrast ratio of tumour on b-800 image was significantly higher than those of other images (*P* < 0.0001).
Conclusion: In preoperative evaluation of small pancreatic adenocarcinoma, the addition of DW imaging to the conventional MR-imaging could improve sensitivity in tumour detection.

B-0156 14:45

Comparison of 320-row perfusion CT-angiography with endoscopic sonography in preoperative diagnostic of isulinomas

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Purpose: To compare the accuracy of preoperative detection of insulinomas between perfusion CT-angiography and endoscopic sonography.
Methods and Materials: A total of 90 patients, main group 45 patients with specific clinical symptoms and Wipple's triad and control group of 45 patients (43.4± 2.8 years) underwent perfusion CT-angiography. Endoscopic sonography was performed for main group of patients. Patients were scanned on 320-detector row CT scanner with following parameters: dynamic volume scan mode, gantry rotation 0.5 sec, scan coverage 10-16 cm, tube voltage

100 kV and tube current 150 mA, slice thickness 0.5x320 mm. IV injection of 60 ml contrast media (320-350 mgI/ml) with flow rate of 5 ml/s was used. The protocol for dynamic pancreas-imaging consisted of 19 intermittent images. Image datasets were reconstructed with 0.5-mm slice thickness and a total of 6,400 images for the entire examination. Analysis of dynamic pancreas images was performed in MPR, MIP projections using 4D cine mode. Respiratory misregistrations were compensated with the software. Perfusion was determined with the gradient relationship technique. Contrast time-density curves and perfusion maps were generated.
Results: Endoscopic sonography was performed in 45 patients and allowed correct localisation of 50/ 66 tumours. Detection rate of perfusion angiography was higher than for endoscopic sonography 61/66 (92.4%). Arterial flow was raised in patients with isulinoma in normal parenchyma comparing to control group ($p < 0.05$).
Conclusion: 320-row perfusion CT-angiography significantly improves diagnostic confidence as compared to endoscopic sonography. Perfusion imaging carries the potential to improve detection of insulinomas due to the significant perfusion differences.

B-0157 14:54

Pancreatic neuroendocrine tumours: correlation between histogram analysis of apparent diffusion coefficient MRI maps and tumour grade

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Purpose: To explore the role of histogram analysis of apparent diffusion coefficient (ADC) MRI maps based on entire tumour volume data in determining pancreatic neuroendocrine tumour (PNT) grade.
Methods and Materials: Retrospective evaluation of 22 patients with PNTs, including low-grade (G1; n=15), intermediate-grade (G2; n=4) and high-grade (G3; n=3) tumours. Regions of interest containing the lesion were drawn on every section of the ADC map containing the tumour and summated to obtain histograms for entire tumour volume. Calculated histographic parameters included mean ADC (mADC), 5th percentile ADC (ADC5), 10th percentile ADC (ADC10), 25th percentile ADC (ADC25), 50th percentile ADC (ADC50), 75th percentile ADC (ADC75), 90th percentile ADC (ADC90) and 95th percentile ADC (ADC95), skewness and kurtosis. Histogram parameters were correlated with tumour grade by repeated measures analysis of variance with Tukey-Kramer post hoc comparisons.
Results: The mADC, ADC75, ADC90 and ADC95 were significantly higher in G1 tumours (1283±267; 1404±300; 1495±318; 1562±347 x 10-6 mm2/s) compared to G2 (892±390; 952±381; 1036±384; 1072±374 x 10-6 mm2/s) and to G3 tumours (733±225; 864±284; 1008±288; 1152±192 x 10-6 mm2/s) (p-value< 0.05). Skewness and kurtosis were significantly different between G1 (0.041±0.466; 2.802±0.679) and G3 (1.01±1.140; 5.963±4.008) tumours (p-value< 0.05). Tumour volume (ml) was significantly higher on G3 (55±15.7) compared to G1 (1.9±2.7) and G2 (4.5±3.6) tumours (p-value< 0.05). In this small sample size, we did not detect statistically significant parameters between G2 (n=4) and G3 (n=3) tumours.
Conclusion: Histographic analysis of ADC maps based on the entire tumour volume can be useful in differentiating histologic grades of PNTs.

B-0158 15:03

Preoperative assessment of the pancreatic fat fraction and fibrosis in patients who underwent pancreatectomy using breath-hold, T2* corrected triple-echo Dixon water-fat separation and diffusion weighted imaging using intravoxel incoherent motion model

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Purpose: To evaluate diagnostic performance of triple-echo Dixon technique and intravoxel incoherent motion (IVIM)-diffusion weighted imaging (DWI) for pancreatic steatosis and fibrosis in the patients who underwent pancreatectomy, and to determine correlation between pancreatic fat, fibrosis and incidence of postoperative pancreas fistula (POPF).
Methods and Materials: This retrospective study was approved by our institutional review board and informed consent was waived. One hundred sixty two patients (M:F=92:70, mean age 62 years) underwent MRI at 3.0 T preoperatively and pancreatectomy. Fat fraction and IVIM-DWI parameters on MR were compared with fat fraction and fibrosis degree (F0-3) of the specimen. In addition, fat fractions and IVIM-DWI parameters were compared in groups with and without POPF. Presence of POPF was determined based on postoperative imaging, lab findings, and contents of surgical drain tubes.
Results: In 162 patients, fat fraction on MR and that of specimen showed a strong relationship (r=0.77). Among the IVIM-DWI parameters, only perfusion fraction was significantly different between F0-1 and F2-3 (30±10% vs. 23.3±9.2%, $p < 0.005$). Fat fraction of the specimen did not show significant correlation with presence of POPF, either.
Conclusion: Pancreas fat and fibrosis can be quantified on preoperative MR but the relationship with POPF and imaging parameters was unclear yet.
Author Disclosures:
J. Lee: Advisory Board; Bayer Schering Pharma. **B. Kiefer:** Employee; Siemens AG Healthcare sector. **B. Choi:** Consultant; Samsung.

B-0159 15:12

Pancreatic adenocarcinoma: comparison of six MRI sequences including diffusion-weighted imaging for tumour conspicuity

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Purpose: To assess the best MR sequences for pancreatic adenocarcinoma conspicuity.
Methods and Materials: Our local institutional review board approved this retrospective study and waived the informed consent requirement. 54 consecutive patients with pathologically proven pancreatic adenocarcinoma underwent MRI (1.5 T, n=27 or 3 T, n=27). Fat-supressed (FS) T1-weighted gradient-echo (GRE), FS T2-weighted, 3D FS dynamic T1-weighted gadolinium-enhanced GRE during arterial, portal and delayed phases and diffusion-weighted imaging (DWI) with b values of 0 and 600 or 800 sec/mm2 were obtained. For each sequence, two gastrointestinal radiologists independently assessed the subjective visual conspicuity using a four-point rating scale (0 to 3). They designated the sequence with the best visual conspicuity. The study coordinator performed a quantitative analysis, placing regions of interest for tumor-to-pancreas contrast (either proximal or distal). The visual conspicuity scores were compared using Fischer's test, and the tumor-to-pancreas contrasts were compared using paired Wilcoxon or t-tests. p-values were considered statistically significant at $p < 0.05$.
Results: 96% of Pancreatic adenocarcinomas appeared hypointense on 3D FS T1 GRE arterial phase, which was the best sequence for tumor conspicuity (2.6±0.7), followed by portal phase (2.2±1.0) and DWI (2.0±1.0)($p < 0.01$). The arterial phase was designated as the best sequence in 50% of cases versus 20% for DWI. Greatest tumor-to-pancreas contrast was noticed on the arterial phase. DWI was not useful for delineating 61% of tumors.
Conclusion: 3D FS T1 GRE arterial phase is the best sequence for pancreatic adenocarcinoma conspicuity. DWI is limited for clear delineation of the tumor.

B-0160 15:21

Is MDCT capable of detecting perineural invasion in pancreatic head cancer?

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Purpose: The aim of study was to find whether MDCT is capable to detect extrapancreatic perineural invasion (EPI) pre-operatively in resectable adenocarcinoma of pancreatic head. To our knowledge, accuracy for diagnosing carcinoma invasion into extrapancreatic neural plexus has not been established.
Methods and Materials: Preoperative-CT-series of 38 patients with resectable adenocarcinoma of pancreatic head were evaluated by two independent observers retrospectively. EPI was identified as confluent tissue of similar attenuation to primary PC extending along neural plexuses pathways. Plexus-Pancreaticus-Capitalis-II (PLX-II:area along inferioposterior pancreatoduodenal artery (IPDA) and jejunal trunk) was assessed as this area is more susceptible for extrapancreatic invasion of pancreatic head cancer. Two patterns of peripancreatic spread were established: confluent tumour spread (Pattern 1) and infiltration (Pattern 2) along known pathway or in retropancreatic adipose tissue.
Results: All patients underwent Whipple-procedure, histologically adenocarcinoma of pancreatic head was confirmed in all patients. EPI was found in 26 patients (68.4%), 19 of them showed intrapancreatic perineural invasion. EPI was more prominent in lager tumours. All 26 patients with positive PLX-II-invasion were correctly diagnosed on preoperative CT-scans by both observers. Interobserver agreement was 92% (Pa=0.922) with Kappa value=0.63, which represents good agreement between two observers. Pattern1 was found in 16 patients, Pattern2 in 10 patients. Sensitivity of MDCT was 99%, specificity 59%, diagnostic accuracy 81%.
Conclusion: MDCT provides sufficient diagnostic information to detect PLX-II-invasion on preoperative CT-series in patients with adenocarcinoma of pancreatic head. Preoperative detection of EPI, which is significant cause of positive surgical margin and tumour recurrence, can influence clinical management of patient-choice to perform surgical treatment or neoadjuvant therapy.

14:00 - 15:30 **Room D**

Cardiac

SS 203

Myocardial ischaemia and late enhancement: MRI

Moderators:
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B-0161 14:00

Combined assessment of stress myocardial perfusion MRI and iterative super-resolution whole-heart coronary MR angiography in detecting coronary artery disease

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Purpose: Stress myocardial perfusion MRI is useful for the detection of coronary artery disease (CAD). Whole-heart coronary MR angiography (WHCMRA) permits non-invasive visualisation of coronary stenoses. However, the additive value of WHCMRA to stress perfusion MRI is not well known. Recently, we have newly developed a super-resolution (SR) technique optimised for WHCMRA. The purpose of this study was to evaluate the value of combined assessment of stress perfusion MRI and SR-WHCMRA for detecting CAD.
Methods and Materials: 43 consecutive patients (71±10 years) with suspected CAD who underwent both coronary angiography (CAG) and cardiac MRI including stress perfusion MRI, LGE and WHCMRA within 1 month were studied. High-resolution WHCMRA was generated by iterative SR technique. The observers recorded the presence of abnormality representing significant CAD for stress perfusion MRI, WHCMRA and the combination of both using 4-point scale, respectively. Stenoses ≥70% was considered significant on CAG.
Results: 129 coronary territories were eligible for the analysis including 20 territories with previous stent implantation. Stress perfusion MRI was diagnostic in all territories. WHCMRA was diagnostic in all coronary trees except for stent segments. On vessel-based analysis, diagnostic performance assessed by area under the ROC curve (AUC) was significantly higher with combined assessment of SR-WHCMRA and stress perfusion MRI (AUC 0.892; sensitivity 87.0%; specificity 83.1%) than with stress perfusion MRI only (AUC 0.741; sensitivity 60.9%; specificity 79.5%) (p=0.0005).
Conclusion: Iterative SR-WHCMRA combined with stress perfusion MRI can provide excellent diagnostic performance for the detection of CAD.

B-0162 14:09

Evaluation of cirrhotic cardiomyopathy in end stage virus C hepatitis by delayed myocardial enhancement

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Purpose: This study aims to evaluate functional and morphological myocardial changes in hepatitis C virus patients with end stage liver disease listed for liver transplantation by cardiac magnetic resonance.
Methods and Materials: Twenty-eight patients with end stage liver disease secondary to hepatitis C virus listed for liver transplantation were enrolled in this study. The mean patient's age was 55±8 years. The mean model for end-stage liver disease score was 25.5 ± 6.3. All patients were subjected to routine laboratory investigations, upper gastrointestinal endoscopy, abdominal ultrasound, 2D-echocardiography and cardiac magnetic resonance.
Results: All patients showed adequate left ventricle contractility with normal wall motion and thickness. Patients showed a normal range of ejection fraction from 55 to 80% with mean 65.5 ±11.8. We found variable degrees of delayed myocardial enhancement in 21 (84%) of our patients. A significant negative correlation was found between the percentage of delayed myocardial enhancement and the ejection fraction, cardiac output, cardiac index and serum albumin level.
Conclusion: We conclude that severe liver cirrhosis secondary to hepatitis C virus causes functional and morphological changes within the myocardium which could be accurately evaluated by cardiac magnetic resonance.

B-0163 14:18

Relevance of small areas of myocardial ischemia in adenosine stress MR

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Purpose: To compare the clinical relevance of reporting all the areas of ischemia observed at visual interpretation of stress perfusion ("radiologic" approach: method 1), versus the hypothesis of reporting only mild-to-moderate areas of ischemia, i.e. > 6% of LV mass ("cardiologic" approach: method 2).
Methods and Materials: Retrospective re-analysis of a series of stress MR, with perfusion acquired after 4' of adenosine infusion at 140 mcg/Kg/min, 3 slices every heart beat allowing a 16 myocardial segments evaluation. MR adenosine stress was reported as positive : In method 1 in the presence of any area of subendocardial perfusion defect, and in method 2 only if at least 2 subendocardial regions (2 half segments in the 16 segments model).
Results: We analysed a series of 274 stress MR, finding out 75 patients with a coronary angiography < 3 months after the diagnostic test. Prevalence of disease among the studied population was 73.3%. Method 1: sensitivity 89.1%, specificity 45%, PPV 81.6% (95%CI :70 to 89); NPV 60% (95% CI 35.7 to 80.2), global accuracy of 77.33%. Method 2: sensitivity78.2%, specificity 75%, PPV 89.6% (95% CI 77.8 to 95.5), NPV (95% CI 37.3 to 72.4), global accuracy of 73.3%.
Conclusion: Exclusion of small areas of ischemia doubled the number of false negative results from 6 to 12. The global accuracy of the exam did not changed between the 2 reporting methods. Therefore, also small areas of myocardial ischemia should be reported in a stress MR report.

B-0164 14:27

No reflow as predictor of adverse outcome in patients with acute myocardial infarction: the role of cardiac magnetic resonance (CMR) and coronary angiography

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Purpose: No reflow (NR) is a phenomenon due to microvascular obstruction (MVO), with partially known implication in STEMI patient's outcome. The best tools to assess the presence of NR are CMR and angiography. The aim of our study is to assess CMR superiority, compared to angiography, to detect MVO and predict patient's outcome.
Methods and Materials: All STEMI patients enrolled in our study underwent percutaneous coronary intervention (PCI) and CMR within 5 days from the acute event. We correlated the occurrence of MVO with the incidence of adverse cardiac events at 1 and at 6 months.
Results: Forty patients (age 61± 10 yrs) were enrolled in the study, 30 of whom have been followed up for 6 months. Twenty-seven patients had evidence of MVO (4.9 ± 4.5%) at CMR, while angiography detected only 14. Three pts experienced events in the 1st month and there was a significant correlation between early events and MVO% (p=0.006), but not with LE extension (p=0.34). Pts with MVO were also hospitalised for a longer period (p=0.06). Among the 30 pts with 6 months follow-up, we recorded events in 9 patients (1 reinfarction, 7 target lesion revascularisation 8 (TLR), 3 new PCI, 2 CABGs). Patients with MVO at CMR presented a higher incidence of TLR (p=0.06). The same correlations were not found for angiographic NR.
Conclusion: These data confirm that CMR is more powerful than angiography in MVO identification. MVO at CMR may help to identify pts with higher incidence of adverse events and TLR need.

B-0165 14:36

Impact of age-related differences on myocardial salvage (MS), micro-vascular obstruction (MVO) and left ventricular remodelling (LV-R) following primary percutaneous coronary intervention (PCI): insights from cardiac magnetic resonance (CMR)

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Purpose: Elderly population is the most represented in acute coronary syndromes; however, only few studies investigated impact of age on myocardial damage in patients presenting with STEMI undergoing primary PCI. Our aim was to evaluate whether differences in terms of MS, MVO and LV-R emerged among different tertiles of age in a population of STEMI patients undergoing CMR.
Methods and Materials: Ninety STEMI patients, subcategorised into 3 tertiles (33-50, 51-65, 66-80 years old, group I, II, III, respectively) according to age, underwent CMR within 5 days after successful PTCA (time-to-reperfusion: 12 hrs within symptom onset) and at 6 months follow-up. Reversible and irreversible myocardial injury indexes of LV-R were quantified and compared among groups.
Results: Infarct size (IS), MVO, LV end-systolic and end-diastolic volumes (ESV; EDV) were larger in group.i. as compared to group III (respectively, p=0.006, p=0.0001, p=0.019, p=0.004) and were associated with more significant acute global systolic dysfunction in the same group (mean ejection fraction: 41.6%; p=0.018). MS was significantly higher in group.i. rather than group III (p=0.039). Positive LV-R was observed at 6 months follow-up only in group III patients (LV-ESV > 20%; p < 0.001).
Conclusion: Our preliminary CMR data suggest that age-related differences exist in acute STEMI patients regarding main indexes of myocardial injury and are characterised by larger extent of IS and larger micro-vascular damage in younger patients and adverse remodelling at follow-up in elderly, likely

reflecting an extreme heterogeneity of early response and late adaptation to myocardial necrosis

B-0166 14:45

How microvascular obstruction impacts on left ventricle remodelling: a cardiac magnetic resonance (CMR) study

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Purpose: The role of CMR in the prognostic stratification of patients with ST-elevation myocardial infarction (STEMI) is still under investigation. Great focus has recently been given to the no reflow phenomenon, caused by microvascular obstruction (MVO). The aim of this study is to evaluate how CMR parameters progressively change after infarction and how MVO impacts on left ventricle (LV) remodelling.
Methods and Materials: In this ongoing prospective study, 43 consecutive STEMI patients, admitted to our ER and treated with PCI, were enrolled and underwent a first CMR study (1.5 T magnet) within 5 days from the infarction. A subgroup underwent a second CMR after 6 months. The main morpho-functional parameters were assessed on both CMRs. End-diastolic volume modification between the second and the first CMR (ΔEDV) was used to evaluate LV remodelling. The criteria for MVO were a subendocardial lack of enhancement on first-pass perfusion sequence and/or the presence of a hypointense region, within the late-enhancement (LE) area.
Results: A group of 14 patients (age 61±9 years) underwent both CMR studies. There was a significant increase in EDV only in the group with MVO as compared to the group without MVO (ΔEDV=32 ±27 ml; p=0.005 vs ΔEDV=4.5±16 ml; p=0.6). MVO, LE and perfusion defects showed a direct correlation with ΔEDV, with a significant relationship at regression analysis (MVO%: p=0.001; R2=0.6; LE%: p=0.005, R-squared=0.5; perfusion defect%: p=0.01; R-squared=0.6). At multivariate analysis only MVO% presented a significant relation with ΔEDV (p=0.02).
Conclusion: These preliminary data suggest that MVO is involved in LV remodelling after myocardial infarction.

B-0167 14:54

3D free-breathing cardiovascular 3 T MRI: late gadolinium enhancement compared to breath-hold 2D imaging

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Purpose: Clinical 3D cardiovascular magnetic resonance imaging (CMR) is desirable, since it allows post-acquisition reformatting in any desired imaging plane. 3D-CMR is hampered by long breath-hold duration, introducing patient discomfort and technical limitations. These limitations can be overcome by application of respiratory navigator techniques, for example to perform late gadolinium enhanced (LGE) CMR. This 3D approach allows to: (1) perform 3D-CMR during free-breathing; (2) increase image resolution; (3) average out heart rate variability by using a phase sensitive inversion recovery sequence (PSIR); (4) improve myocardial nulling, especially relevant at higher MR field strength such as 3 T. Therefore, the purpose of the present study was to develop and clinically test free-breathing 3D-LGE-CMR using a respiratory navigator approach at 3 T in comparison to standard 2D breath-hold.
Methods and Materials: Between May 2012 and June 2013, 3D and 2D-PSIR sequences were acquired after administration of Dotarem (Guerbet). Retrospectively, 26 patients with LGE were selected for analysis (21 men; mean age ± standard deviation: 62.2±7.8). Myocardial scar tissue (ml), SNR, CNR and edge sharpness (ES) of scar tissue were quantified. Parameters were compared with a paired t-test.
Results: Myocardial scar tissue volume (3D: 27.11±17.94; 2D: 29.50±15.43 ml; p = 0.49), SNR (3D: 100.88±31.97; 2D: 89.92±18.57; p=0.06) and CNR (3D: 3.96±1.84; 2D: 3.55±0.68; p=0.25) were not significantly different between 3D and 2D sequences. ES was significantly higher for 3D CMR (3D: 0.051±0.0072; 2D: 0.048±0.0085; p=0.019).
Conclusion: Free-breathing 3D-LGE-CMR enables reliable myocardial scar tissue assessment with improved image resolution as compared to standard 2D breath-hold imaging.

B-0168 15:03

Cardiac magnetic resonance imaging findings and the risk of cardiovascular events in patients with recent myocardial infarction or suspected or known coronary artery disease: a systematic review of prognostic studies

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Purpose: The purpose of this study was to investigate the association between CMR findings and future cardiovascular events by systematically reviewing the current literature.
Methods and Materials: Cohort studies published before 2013 identified by systematic MEDLINE and EMBASE searches and citation tracking were evaluated. Studies evaluating associations between CMR findings (left ventricular ejection fraction [LVEF], wall motion abnormalities [WMA], myocardial perfusion, microvascular obstruction [MVO], late gadolinium enhancement [LGE], edema, and intramyocardial haemorrhage [IMH]), and hard events (all-cause mortality, cardiac death, cardiac transplantation, myocardial infarction) or major adverse cardiovascular events (MACE) were included.
Results: Of the 3,040 (MEDLINE) and 656 (EMBASE) articles retrieved, 56 matched our selection criteria (n=25,497 patients). For patients with a recent myocardial infarction, no relation was found between CMR findings and hard events, but late MVO (adjusted hazard ratio (HR)-range: 1.03-10.4, 668 patients) and IMH (adjusted HR-range: 1.17-2.80, N=749) were independently associated with MACE. In patients with suspected/known CAD, inducible WMA (adjusted HR-range: 1.87-2.99, N=2,863), and inducible perfusion defects (adjusted HR-range: 3.02- 7.77, N=4,012) were independently associated with hard events. Inducible perfusion defects were also associated with MACE (adjusted HR-range: 1.76-3.21, N=2,392). For other CMR findings, either no association was found or few studies were available.
Conclusion: Among patients with a recent myocardial infarction, late MVO and IMH are independently associated with MACE. In patients with suspected/known CAD presence of inducible WMA are associated with hard events and inducible perfusion defects are associated with hard events and MACE.

B-0169 15:12

Size of late gadolinium enhancement in patients with hypertrophic cardiomyopathy in correlation with serum MMP9 as an indicator of myocardial fibrosis

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Purpose: We compared size of late gadolinium enhancement (LGE) obtained by cardiac magnetic resonance (CMR) imaging in patients with hypertrophic cardiomyopathy (HCM) with serum MMP9, which is a marker of myocardial fibrosis.
Methods and Materials: CMR was performed in 50 patients with HCM (mean age: 54.9 ±14.1 years, 27 women) using a 1.5 Tesla scanner (Achieva, Philips). Size of fibrosis was quantified in percent of total myocardium on inversion-recovery images after injection of 0.2 ml/kg gadolinium using the HeAT software and compared with levels of serum MMP9. A serum level of > 46 ng/ml was regarded as increased.
Results: Nine out of 50 patients with HCM (18 %) showed no fibrosis on LGE-CMR. In the remaining 41 patients, mean size of fibrosis was 13.3±10.3% on LGE-CMR. In all patients, the mean MMP9 level was 54.4±35.2 ng/ml. Size of fibrosis on LGE-CMR strongly correlated with MMP9 levels (R2=0.557, Pearson's r= 0.75, $p < 0.01$). In the 9 patients with no LGE, MMP9 was with 29.6 ± 14.2 ng/ml significantly lower compared to the 41 patients with LGE and levels of 59.8 ± 36.2 ng/ml (p =0.01).
Conclusion: Size of fibrosis on LGE-CMR strongly correlated with the serum fibrosis marker MMP9 in patients with HCM. However, 2% of patients revealed no LGE despite increased MMP9 levels. These patients may have a diffuse myocardial fibrosis which is not detectable by standard LGE-CMR.

B-0170 15:21

Do left ventricular volumes correlate with late enhancement in hypertrophic cardiomyopathy?

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Purpose: To correlate left ventricular volumes and late enhancement (LE) mass in patients with hypertrophic cardomyopathy.
Methods and Materials: We retrospectively evaluated 85 patients with HCM diagnosis. All patients were studied with a 1.5 T MR. The study protocol included cine True-Fisp sequences (TR:3.09 ms,TE:1.3 ms, FA:80,thick:8 mm) followed by inversion recovery Turbo-Flash sequences for LE evaluation (TR:8 ms,TE:4 ms,TI:250-340 ms,thick:8 mm) acquired 10-15 minutes after iv administration of 0.2 mmol/kg of Gadolinium. Left end-diastolic volume (EDV), end-systolic volume (ESV), stroke volume (SV), ejection fraction (FE) and LE mass was measured on short axis by manual planimetry using a dedicated software. LE was considered as an area with SI> 6SD from normal tissue. Patients were divided in two different subgroup with LE (Group 1) and without LE (Group 2). For statistical analysis we used Spearman's correlation.
Results: The following results were observed respectively in Group 1 and 2: LE mass 12±16 g, EDV 121±37 ml, ESV 39±21 ml, SV 87±23 ml, EF 72±9% in Group 1 and EDV 115±29 ml, ESV 31±18 ml, SV 84±20 ml, EF 76±9% in Group 2. Patient with LE presented higher EDV, ESV, SV and lower EF in comparison to patients negative for LE. Significant correlation was not observed between LE mass and EDV (p=0.6) and SV (0.25) while statistical

significant correlation was observed between LE mass, ESV (0.01) and EF (0.0001).
Conclusion: This study show that an increase of LE mass is correlated with a decrease of left ventricle EF and increase of ESV.

14:00 - 15:30 **Board Room B**

Head and Neck

SS 208

Pathologies of the orbit and temporal bone

Moderators:
T. Rodt; Hannover/DE
B.F. Schuknecht; Zurich/CH

B-0171 14:00

Exploration of orbital and orbital soft-tissue volume changes with gender and body parameters by using magnetic resonance imaging
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Purpose: Understanding the volumetric values of eyeball and changes with age and gender will allow us to solve serious clinical implications. This study aimed to examine the total orbital volume (TOV) and total orbital fat expansion (TOFE) in normal people with three different age groups and to find the correlation of these measurements due to age, gender and body parameters (height and weight) by MRI.
Methods and Materials: MRI data were acquired retrospectively. Total of 1453 subjects were included and were divided into three age groups: 481 subjects in 20-30 years age (240 males and 241 females), 521 subjects in 40-60 years age (253 males and 268 females) and 451 subjects in 60-70 years age (212 males and 239 females). The TOV and TOFE were measured using T1-weighted MR images for each subject, and clinical information's (age, gender, height and weight) were also obtained.
Results: The measurements showed that TOV decreased by age and the volume was larger in men than in women. While both weight and height showed positive correlations with TOV in male and female subjects in their 20s and 40s, only weight showed a positive correlation with TOV in female subjects in their 60s. On the other hand, TOFE increased by age in all groups and the increment was larger in women than men.
Conclusion: These results provide basic information about the effect of age, gender, and body parameters on TOV and TOFE. The variations in TOV are associated with orbital soft tissues changes rather than with TOFE.

B-0172 14:09

Orbital colour Doppler ultrasound assessment in patients affected by Leber's hereditary optic neuropathy and dominant optic atrophy
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Purpose: To investigate the vascular dysfunction in patients with Leber's hereditary optic neuropathy (LHON), and with dominant optic atrophy (DOA), that are genetic diseases which cause visual loss due to microvascular disorders.
Methods and Materials: Six asymptomatic LHON patients (cLHON), 2 acute patients (aLHON), 8 chronic patients (chLHON), 6 patients with DOA, and 10 control subjects underwent a complete ophthalmologic examination including enhanced depth imaging--optical coherence tomography, and OCDUS performed with a ATL-Philips IU-22, and a 5-12 MHz linear probe. Patients were examined with closed eyelids in supine position. Peak systolic velocity (PSV), end-diastolic velocity (EDV), and resistive index (RI) of ophthalmic artery (OA), central retinal artery (CRA), central retinal vein (CRV), short posterior ciliary arteries (SPCA).
Results: In cLHON: SPCA EDV (cm/s)=5.0±1.4, SPCA RI=0.64±0.16, OA RI=0.59±0.06, in controls, respectively: 2.4±0.6 (P=0.001), 0.76±0.03 (P=0.02) and 0.75±0.04 (P=0.001); SPCA in aLHON: EDV=7.1±2.1, PSV (cm/s)=21.3±4.5, RI= 0.67±0.03, in controls, respectively: 2.4±0.6 ($P < 0.001$), 10.3±2.8 (P=0.001) and 0.76±0.03 (P=0.005); CRA PSV: in chLHON= 8.6±2.3 (P=0.04), in aLHON=15.4±0.9, in controls=12.9±3.0; SPCA RI in aLHON=0.67±0.03, in chLHON=0.80±0.0 (P=0.002); SPCA PSV: in DOA= 7.2±1.6, in controls=10.3±2.8 (P=0.01). A significant PSV increase of both CRA and SPCA in aLHON, compared to cLHON and to controls, and a subsequent reduction in the chronic phase and in DOA was found.
Conclusion: OCDUS can be a useful diagnostic tool to investigate the vascular involvement, probably related to the microangiopathy, of LHON and DOA at different stages of the disease, providing quantitative and reproducible data: in the future, OCDUS could monitor the response to treatment.

B-0173 14:18

Feasibility of 3 T IDEAL MR of the orbits for imaging of Graves' ophtalmopathy: correlation between quantitative evaluation of extraocular muscle size and proptosis value
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Purpose: To investigate the feasibility of 3 T MR iterative decomposition of water and fat imaging (IDEAL) sequences for imaging of Graves' ophtalmopathy, assessing extraocular muscle size and proptosis value.
Methods and Materials: 3 T IDEAL MRI was performed on 56 patients with symptoms of Graves' orbitopathy. Coronal and axial T2-weighted IDEAL fast spin-echo sequences were acquired in all patients; axial scans were obtained in the neuro-ocular plane. Since IDEAL sequences permit fast and accurate water-fat separation with a single acquisition, we measured maximum cross-sectional area of extraocular muscles (EOM) on coronal T2 sequences after a visual comparison between water-only and fat-only images with a free-hand ROI. Proptosis value was quantified on axial images with Hertel Index, i.e. the distance from the interzygomatic line and the apex of the globe; correlation was measured with the Pearson correlation coefficient.
Results: We found a moderate correlation ($p < 0.05$) between Hertel index and areas of EOM (right: r=45-59, left: r=40-52); this association was stronger for inferior, medial and superior rectus muscles and even stronger combining all areas for each orbit (right: r=60; left: r=56).
Conclusion: Orbital 3 T IDEAL MR imaging is a fast and useful procedure in the evaluation of patients with Graves' ophtalmopathy. In a single acquisition, this technique provides excellent water and fat separation, thus permitting an accurate and reproducible quantification of muscle hypertrophy and proptosis value; in facts artifacts deriving from incomplete or wrong fat suppression with conventional techniques are markedly reduced.

B-0174 14:27

Dynamic contrast-enhanced magnetic resonance imaging of ocular melanoma
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Purpose: Dynamic contrast-enhanced magnetic resonance imaging (DCE MRI) is used for assessment of microvasculature in several tumours. We aimed to assess the contrast signal enhancement characteristics of ocular melanoma.
Methods and Materials: Forty patients with ocular melanoma were prospectively investigated with ocular MRI including DCE sequences during a 13-month period. A region-of-interest analysis of the images was performed to calculate the time to achieve the maximum enhancement (Tmax), the washout-ratio (WR), the enhancement ratio (ER) and the maximum rise slope (SL) within 106 seconds of the ocular melanoma in all patients. Ocular melanomas were grouped with respect to their enhancement curve pattern.
Results: In 39 patients (98%), the ocular melanomas showed an early strong signal enhancement after contrast injection, resulting in a mean Tmax of 49 sec. The mean WR of the ocular melanoma was 21.3%. In 30 patients (75%), the peak enhancement was followed by a washout of more than 10%. In 9 patients (23%), the washout was less than 10 % resulting in a plateau pattern.
Conclusion: Ocular melanoma demonstrates signal enhancement characteristics of hypervascular neoplasms. This study provides baseline curve pattern data that may be useful for assessing changes in vascularity, e.g. during therapy response.

B-0175 14:36

Contrast-enhanced ultrasound in the quantitative assessment of uveal melanoma response to gamma knife radiosurgery: do changes in tumour vascularisation precede thickness variation at ultrasound?
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Purpose: To prospectively analyse CEUS in the quantitative assessment of UM response to GKR, investigating if changes in tumour vascularisation precede thickness variation, the conventional US response parameter, which on average occurs at 12 months.
Methods and Materials: Ten patients (7 males, 3 females; mean age±SD, 66.2±12.62 years) with UM were treated with GKR. US and CEUS were performed (*SonoVue, Bracco*) with iU-22 ATL (Philips) and a 5-9 MHz linear probe at baseline, 3, 6, and 12 months after treatment. UM transverse diameter, thickness, and different quantitative parameters, such as area-under-the-curve in the wash-in-phase, wash-in-perfusion-index, peak-enhancement, and wash-in-rate, were calculated using a dedicated software (Sonotumor, Bracco).
Results: At US the mean tumour thickness (mm) after GKR was: at baseline= 8.3, 3 months after= 7.4 (P=ns), 6 months after= 6.6 (P =0.031), 12 months

after= 5.8 (P=0.024). At CEUS, the parameters at baseline, 6 months and 12 months after treatment resulted respectively: peak-enhancement (a.u). = $2*10^7$, $8*10^5$ (P=.018), $4*10^1$ (P=.028); wash-in rate (a.u). = $4*10^6$, $8*10^4$ (P=.028), $7*10^0$ (P=.028); wash-in perfusion index (cm^3/sec) = $6*10^7$, $2*10^6$ (P=.028), $1*10^2$ (P=.043); area under the curve (a.u). = $9*10^8$, $3*10^7$ (P=ns), $1*10^3$ (P=.028). At 6 months after treatment, tumour thickness decreased in 6/10 patients, while UM enhancement in 10/10.
Conclusion: CEUS showed an early UM enhancement reduction at 6 months after GKR. A larger population is needed to investigate if CEUS could be either an additional tool to conventional US or the first choice technique to monitor UM response to GKR.

B-0176 14:45

Imaging of perilymph fistulae of the round and oval windows in the absence of a fracture

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Purpose: To evaluate reliability of CT and MRI in diagnosing perilymph fistulae (PLF) of the round window (RW) and oval window (OW), in the absence of a fracture.
Methods and Materials: Amongst all patients (n = 101) clinically suspected of FPL, 61 have a CT, 40 MRI (including 31 CT + MRI) studied by three radiologists (two seniors, one junior) with reference to a normal population in CT (n = 30).
Results: The sensitivity and specificity for the FR in MRI are better than CT: respectively 94.4%(IRM), 90.3% (TDM) et 95.5% (IRM)/93.3 % (TDM). CT and MRI produce the same results for the sensitivity analysis of the FO: 92.3 % (IRM)/85.7 % (TDM). However, the specificity for the FO in CT (97.9%) is higher than that of MRI (96.3%). By combining the two techniques, the sensitivity was 90%, positive predictive value (PPV) was 100%. False positive cases were explained by difficulty differentiating between inflammatory and perilymphatic fluid, false negatives by intermittent flow fistulae.
Conclusion: CT and MRI can play a key role in diagnosing PLF.

B-0177 14:54

Functional MSCT of temporal bone as a new standard in differential diagnostics of a conductive hearing loss

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Purpose: to assess possibilities of fMSCT in evaluation of ossicular mobility in patients with conductive hearing loss in comparison with healthy individuals.
Methods and Materials: 75 persons (107ears) have been examined by audiologic tests, fMSCT: 13 healthy adult volunteers and 62 patients with conductive hearing loss. CT was performed on 320-detector CT with dynamic scan mode with simultaneous exposure of sound signal. 46 patients (56ears) were underwent otosurgery.
Results: We evaluate 6 main criteria of normal ossicular mobility in healthy volunteers. In patients' group we revealed the follow pathology: 17 patients with otosclerosis had restriction or absence of motility of stapes footplate; 10 patients with adhesive otitis media had decrease degree of motion of ossicles chain; 4 patients with tympanosclerosis had absence of motility of malleus; 3 patients had absence of motion due to rupture of incudostapedial joint and one patient with hypoplasia of ossicular chain had loss of motion. From the group of 27 patients with previous stapedoplasty we observed 11 cases of prosthesis dysfunction due to: compression by otosclerotic focus (5 cases), the loop of prosthesis slid off the long limb of at movement (2 cases), the loop was opened and adjoined an tympanic membrane (2 cases), fracture of the long limb of incus (2 cases). All CT-findings were compare with otosurgery results and correlation were 98%.
Conclusion: FMSCT is a new noninvasive diagnostic method for evaluation of ossicular mobility, that helps to choose an optimal surgical approach in patient with conductive hearing loss.

B-0178 15:03

Size of the membranous inner ear in different ages and sexes: volumetric assessment using three dimensional reconstructed high resolution MRI of the inner ear

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Purpose: Volumetric assessment of the membranous inner ear in different ages and to check the differences in volume among both sexes and between both sides in the same patient using three dimensional (3D) reconstruction of the high-resolution MR-Imaging (HR-MRI).
Methods and Materials: 350 patients with a mean age of 48.5year were included. HR-MRI was performed using a T2-weighted SPACE sequence with 0.6 mm slice thickness. 3D-reconstructions were performed using Advantage Workstation. Volumetric assessment was manually performed for each side in all patients. The difference between different ages was tested using Pearson-linear-regression test. The difference between both sides and sexes was tested using student T-test and Wilcoxon-Mann-Whitney test respectively.
Results: The mean volume of the left inner ear in all patients was 0.526 mm3 (SD:0.097, Range:0.300-0.870). On the right side it was 0.520 mm3 (SD:0.010, Range:0.270-0.910). The mean volume of the inner ear was 0.520 mm3 (SD:0.099, Range:0.300-0.870) and 0.527 mm3 (SD:0.098, Range:0.270-0.910) in females and males respectively. No statistically significant difference was noted between both sides in the same patient (p=0.37) or between both sexes (p=0.48). A statistically significant reduction in the volume of the inner ear with increased age was noted ($p < 0.0001$). The volume of the inner ear is significantly reduced by 0.0017 mm3 every year of age.
Conclusion: The volume of the inner ear is significantly reduced with increased age at a rate of 0.0017 mm3/year of age. There is no significant difference in volume between both sexes or both sides in the same patient.

B-0179 15:12

Orbital Colour-Doppler Ultrasound (OCDUS) and Spectral-Domain Optical Coherence Tomography (SD-OCT) assessment in brittle type 1 diabetic (T1D) patients after timely percutaneous intraportal pancreatic islet transplantation (PIPIT)

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Purpose: PIPIT is a less invasive alternative to pancreas transplantation. Diabetic retinopathy (DR) represents the major cause of visual loss in T1D patients. OCDUS and SD-OCT are fast/non-invasive examinations: the first quantifies the peak systolic velocity of central retinal artery (PSV-CRA), the second allows high-resolution cross-sectional retinal images. Our aim was to assess the clinical relationship between retinal blood flow and morpho-structural retinal changes after PIPIT.
Methods and Materials: Eight T1D patients, 5 affected and 3 unaffected by DR, were submitted to OCDUS and SD-OCT before and after PIPIT. DR, based on fundus biomicroscopy, PSV-CRA with OCDUS, macular thickness and presence of micropseudocysts (MPCs) with SD-OCT, C-peptide (Cp), as a biomarker of islet function, were assessed at baseline and at 1, 2, 3, 4, 5 years from PIPIT. Statistical analysis was performed by Mann-Whitney U Test.
Results: PSV-CRA, in patients with and without DR, respectively, was as follows: before PIPIT 7.86 ± 1.38 cm/s vs 8.06 ± 1.50; after PIPIT 8.39 ± 1.01 cm/s vs 12.61 ± 2.73 ($p < 0.05$). SD-OCT showed a retinal thickness ≤250 microns, but the presence of MPCs in 2 patients with DR. Cp, in patients with and without DR, respectively, was as follows: before PIPIT 0.76 ± 0.48 ng/ml vs 0.62 ± 0.48; after PIPIT 0.72 ± 0.51 ng/ml vs 1.32 ± 1.21.
Conclusion: A timely PIPIT in brittle T1D patients, still unaffected by DR, determines a restoration of islet function and a beneficial effect on the retinal microcirculation, improving PSV-CRA and Cp values.

B-0180 15:21

Volumetric assessment of the cochlea in patients with long-standing unilateral sensorineural hearing loss: comparison with the normal side

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Purpose: To compare the cochlear volume of the diseased side in patients with long-standing unilateral hearing loss with the cochlear volume of the normal side using three dimensional (3D) reconstruction of the high-resolution MR-Imaging (HR-MRI) sequences.
Methods and Materials: 81 patients with a mean age of 45.2 years were included. All patients had long-standing unilateral hearing loss. HR-MRI was performed using a T2-weighted SPACE sequence with 0.6-mm slice thickness. 3D reconstructions were performed using Advantage Workstation. The difference between the cochlear volume of the normal and the diseased side was tested for statistical significance using the two-sample t test.
Results: Unilateral hearing loss affected the right side in 35 patients and the left side in 46 patients. The mean cochlear volume in all patients and both sides was 0.1721 mm^3 (Standard deviation (SD): 0.0303, range: 0.1000 - 0.2800 mm^3). The mean volume of the cochlea in the diseased side was 0.1717 mm^3 (SD: 0.0287, range: 0.1000 - 0.2700 mm^3). The mean volume of the cochlea in the normal side was 0.1725 mm^3 (SD: 0.0320, Range: 0.1100 - 0.2800 mm^3). There was no statistically significant difference between the volume of the cochlea on the diseased side and the normal side ($p = 0.87$).
Conclusion: There is no statistically significant difference in the cochlear volume between the diseased side and the normal side in patients with unilateral long-standing sensorineural hearing loss.

14:00 - 15:30 **Room E1**

Musculoskeletal

SS 210

Knee, ankle and foot

Moderators:
C. Faletti; Turin/IT
J. Renoux; Paris/FR

B-0181 14:00

Treatment of non-traumatic posteromedial knee pain due to semimembranosus tendinopathy: a study assessing the efficacy of ultrasound guided injections in 92 patients

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Purpose: Assess effectiveness of ultrasound (US) guided steroid injections in the management of posteromedial knee pain due to semimembranosus tendinopathy (SMT).
Methods and Materials: 92 (42 male, 50 female) patients (mean age 42 years) referred for MRI over a 5 year period with medial knee pain had a diagnosis of semimembranosus tendinopathy made. The patients were subsequently referred for US confirmation after which an US-guided injection of 40 mg triamcinolone and 2 ml 0.5% Bupivacaine was administered. Patients were reviewed at 1 week, 4 weeks, 3 and 6 months. VAS pain scores were recorded pre-procedure and post procedure.
Results: MRI showed tendon thickening with intratendinous high SI and fluid in the adjacent bursa on fat saturated images. Sonography confirmed thickening of the tendon with varying degrees of hypoechogenicity ± inflammatory changes in the adjacent bursa. Significant VAS pain score reduction was observed after injection when compared to that at presentation. US also showed improvement in tendon fibrillar morphology.
Conclusion: Semimembranosus tendinopathy (SMT) should be actively sought as a potential aetiology when reviewing an MRI of the knee, especially in patients presenting with medial knee pain as it is a frequent and easily treatable cause of knee pain. SMT has been described in the past as being secondary to a compensatory biomechanical mechanism in patients with significant intra-articular pathology but our study shows that it can also be found in young individuals suffering from non-traumatic medial knee pain. Ultrasound can confidently confirm the diagnosis, guide injections and monitor changes of SMT.

B-0182 14:09

Total knee arthroplasty: early post-surgical malrotation

M. Ereno Ealo, E. Pastor Ausin, B. Sancho Garaizabal, E. Montejo, F.M. Labayru Echevarria; *Galdacano/ES (mjereno@gmail.com)*

Purpose: Pain after TKA Surgery: CT showing early malrotation and benefits of correction.
Methods and Materials: 35 knee arthroplasty revisions were performed in patients with a persistent pain after an uncomplicated TKA. Cases of component loosening or infection were excluded. The component rotation measurement was based on the technique described by Berger et al. Femoral component rotation: angle between the trans epicondylar axis and the posterior condylar axis. (0-3º in women and 3-5º in men). Tibial component rotation: 3 slices at different levels were analysed including the tip of the tubercle. (neutral n 18º and internally rotated when larger). Knee Society Prosthesis Score, Knee Society Function Score, Oxford Scores, Range of motion, Laxity, Patellar maltracking and Pain were evaluated pre and post-surgery in all patients.
Results: Mean preoperative femoral rotation was -2.6º. Mean preoperative tibial rotation was -4.3º. Mean preoperative femoral and tibial rotation was -6.8º. Knee Society Prosthesis Score: 42.3 (10-62) in pre revisions and 78.8 (65-95) in post surgery revisions. Knee Society Function Score: 37.7 (5-60) in pre-revisions and 48.9 (10-85) in post-surgery revisions. Range of motion: 85.9 (50-125) in pre-revisions and 105.9 (85-135) in post-surgery revisions. In all cases p value < 0.001
Conclusion: These was a significant improvement experienced by patients after TKA revision for malrotation. The CT is recommended in the evaluation of patients with early painful TKA and no evidence of infection.

B-0183 14:18

The clinical impact of leukoscan imaging in managing peri-prosthetic joint infection

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Purpose: Three phase bone scintigraphy followed by Leukoscan imaging is a popular investigative cascade for the diagnosis of infected total hip and knee replacements. This study analyses how the use of Leukoscans in a UK secondary hospital setting impacts on the management of suspected peri-prosthetic joint infection.
Methods and Materials: Case based analyses were performed covering a 24 month period (2010-2012), inclusive of clinical follow-up. Patients had triple phase bone scintigraphy followed by a Leukoscan. The corresponding clinical action, inclusive of further investigations and management, was examined. Further investigations included a 24-hour repeat of the Leukoscan and joint aspiration for microbiological confirmation of infection. Management was categorised into the following broad categories: no action, conservative management, and surgery.
Results: 55 patient cases were analysed. Triple phase bone scintigraphy was positive in 89% and negative in 11%. Leukoscans yielded positive results for infection in 55% and negative in 45%, with 22% of patients receiving a 24-hour repeat Leukoscan. Microbiological confirmation was sought in 47% in which all cultures of joint aspirate were negative. The result of the Leukoscan prompted a change in management in 66%, in which 33% received conservative management and the remaining 33% underwent revision surgery. No change in management was observed in 34%.
Conclusion: Triple phase bone scintigraphy is best used as a screening test. When negative it confidently rules out disease. Accuracy of isolated Leukoscans remains controversial. This study suggests that there is no robust correlation between the results of a Leukoscan and the resultant clinical action.

B-0184 14:27

MR findings in asymptomatic volunteers at the calcaneal attachment of the plantar fascia

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Purpose: To assess MR findings at the calcaneal attachment of the plantar fascia in asymptomatic volunteers.
Methods and Materials: The study was approved by the institutional review board and informed consent was obtained. MR examinations of 77 asymptomatic volunteers (40 women, 37 men; mean age 48.0 years, range 23-83 years) were obtained. Two msk fellowship trained radiologists analysed signal characteristics and thickness of the medial, central and lateral fascicle of the plantar fascia were assessed. Moreover, the presence of soft tissue oedema, bone marrow oedema and bony spur formation at the attachment of the plantar fascia was noticed.
Results: Mean thickness of the plantar fascia was 4.0 mm (central fascicle), 0.6 mm (medial fascicle), and 2.3 mm (lateral fascicle). Increased signal intensity in the plantar fascia was seen in 16 volunteers (20.8%) in the T1w sequence, in 6 volunteers (7.8%) in the T2w sequence and in 5 volunteers (6.5%) in the STIR sequence. Soft tissue oedema above the plantar fascia was seen in 5 volunteers (6.5%) and below the plantar fascia in 16 volunteers (20.8%). A calcaneal spur was noted in 15 volunteers (19.5%). Calcaneal bone marrow oedema was present in 4 volunteers (5.2%).
Conclusion: Soft-tissue oedema below the plantar fascia as well as calcaneal spurs are common findings in asymptomatic volunteers and should be used with caution for diagnosing plantar fasciitis. Increased signal on fluid sensitive sequences within the plantar fascia is less frequent in asymptomatic volunteers.

B-0185 14:36

High-volume image-guided injection with or without steroid for achilles tendinopathy: a prospective study

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Purpose: High-volume image-guided injections (HVIGI's) have been shown to improve outcomes in Achilles tendinopathy patients. The injection traditionally contains Hydrocortisone Acetate, however this prospective cohort study was the first to assess the injection with no steroid, just saline. Aiming to ascertain any difference in the outcomes of pain, function, symptoms and return to sporting activity between patients receiving a HVIGI with steroid, and without.
Methods and Materials: Patients were recruited consecutively from the London Independent Hospital. 21 patients (24 tendons) were injected with a HVIGI of either 10 Mils of Marcaine 0.5% mixed with 25 mg of hydrocortisone plus 40 Mils of Normal Saline (with steroid) or 50 Mils of Saline plus local anaesthetic (without steroid). All patients were placed on an eccentric loading exercise (ELE) programme. The Victorian Institute of Sports Assessment - Achilles tendon (VISA-A) questionnaire was the primary outcome measure, secondary outcome measure was a VAS scale.
Results: VISA-A scores improved significantly in both groups, from a pre-injection mean of 39.3 to 60.7 in steroid cohort, and from 42.0 to 73.5 in the non-steroid group at final follow-up. Improvements in VAS scores were seen in both groups. No statistically significant difference in VISA-A scores between the two groups at any point (p=0.703).
Conclusion: HVIGI without steroid shows similar trends in pain reduction and functional improvement in comparison to currently used HVIGI with steroid.

Further research with imaging outcomes and longer follow-ups is necessary, however these findings suggest a non-steroid injection is a viable option.

B-0187 14:45

A new protocol of MRI evaluation of two different techniques in anterior cruciate ligament recontruction

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Purpose: The aim of this study is to evaluate integration and maturation of autologous graft in anterior cruciate ligament (ACL) reconstruction with magnetic resonance imaging (MRI) and to evaluate correlation between MRI findings and clinical outcome at 6-month follow-up.
Methods and Materials: 40 patients (range 17-49 yrs, M/F 35/5) treated with ACL reconstruction were evaluated with MRI 6 months after surgery. 20 were treated with "all-inside" technique (half femoral tunnel HFT) and 20 with "over the top" technique (complete femoral tunnel CFT). A new sequence protocol was optimisated for the analysis of the graft structure including DP with and without fat saturation on sagittal and coronal sequences and FSE-T2-3D ±FS. Figueroa scoring scale was used to evaluate integration (presence of synovial fluid at tunnel-graft interface), ligamentation (graft signal pattern: hypointense, isointense or hyperintense) and characterisation of the graft (poor or adeguate). IKDC score, KOOS and Tegner scale were collected.
Results: Synovial fluid at tunnel-graft interface was present in 6 cases with HFT and in 7 cases with CFT. The graft signal pattern was iso-hypointense in 13 cases with HFT and 13 cases with CFT, whereas it was hyperintense in 7 cases with HFT and 7 cases with CFT. The characterisation of the graft was poor in 3 patients with HFT and no cases were observed in CFT group.
Conclusion: MRI findings at 6-month follow-up demonstrate no statistically significant differences between two groups in terms of integration assessment and graft maturation (ligamentation), whereas "all-inside" technique has a better clinical outcome.

B-0188 14:54

Qualitative and quantitative assessment of vastus medialis muscle atrophy at MR imaging in asymptomatic patients after anterior cruciate ligament reconstruction

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Purpose: To quantitatively and qualitatively assess the vastus medialis muscle, an important clinical indicator for postoperative knee function, at MR imaging in asymptomatic patients with anterior cruciate ligament (ACL) reconstruction. The non-operated leg served as internal control.
Methods and Materials: Prospective IRB approved study with written informed patient consent. Thirty-five asymptomatic patients (men, 23; women, 12) with ACL-reconstruction underwent MR imaging of both legs using an axial T1-weighted and a 3D spoiled dual gradient-echo (LAVA FLEX) sequences. Muscle volume and fat-signal-fraction (FSF) of the vastus medialis muscles were determined. Additionally, two readers evaluated fatty muscle atrophy using the Goutallier classification. Student t test was used to test significant muscle volume, muscle FSF, and fatty atrophy differences between the operated and non-operated legs. A p-value <.125 indicated statistical significance.
Results: The vastus medialis muscle volume was significantly smaller in the operated (mean±SD, 430.6±119.6 cm3; range, 197.3-641.7 cm3) compared to the non-operated leg (mean±SD, 479.5 ±124.8 cm3; range, 261.4-658.9 cm3) (p.&gt125). The mean±SD percentage side-to-side difference in muscle volume was 10.2±8.5% (range, -7.1- 30.1%) and in FSF 5.8±22.6% (range, -38.9-40.1%). Qualitative assessment of muscle atrophy revealed no significant differences between the operated and non-operated leg (p=.30 for reader 1; p=.20 for reader 2).
Conclusion: In asymptomatic patients with ACL-reconstructions, a significant atrophy of the vastus medialis muscle exists, but without fatty degeneration.

B-0189 15:03

Magnetic resonance imaging findings after lateral ankle trauma in injured and contralateral ankles

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Purpose: To determine the prevalence of structural MRI abnormalities after lateral ankle trauma in injured and contralateral asymptomatic ankles to identify lesion types that may be preexistent
Methods and Materials: 195 patients (mean age 37.5 years; 43% male) included in an observational case-control study on persistent symptoms after lateral ankle trauma completed a questionnaire and MRI (1.5 T) of both ankles 6-12 months after visiting their general practitioner for an inversion ankle trauma. Prevalence of ankle lesions was compared between injured and contralateral ankles. Multivariable analysis was performed to investigate the association between lesions frequently seen in both ankles (i.e. anterior talofibular (ATFL) and calcaneofibular ligament (CFL) lesions) and recent trauma, previous trauma, age, gender, BMI and osteoarthritis.
Results: Bone marrow edema, joint effusion, soft tissue edema and peri-articular calcifications were found in both ankles, but significantly more frequently in the injured ankle. Peroneal tendon lesions were rarely seen in both ankles. Anterior and posterior tibiofibular ligament lesions, deltoid ligament lesions and signs of talonavicular osteoarthritis were almost exclusively found in the injured ankle. ATFL and CFL lesions were frequently found in both ankles, in 55.9% and 37.4% of the injured ankles, respectively and in 17.9% and 5.6% of asymptomatic contralateral ankles, respectively. ATFL lesions were related to recent trauma, gender and age, CFL lesions were related to recent trauma and gender.
Conclusion: The prevalence of structural MRI abnormalities in injured and asymptomatic ankles is high, suggesting that some lesions (especially ATFL and CFL lesions) are pre-existent.

B-0190 15:12

Ligamentous injury patterns and risk of associated tissue damage in athletes with ankle sprain

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Purpose: To describe retrospectively the structural injury pattern in athletes that were referred to MRI for evaluation of acute ankle sprain and to assess the risk of associated traumatic tissue damage beyond lateral and syndesmotic ligament involvement.
Methods and Materials: 261 ankle MRIs of athletes with acute ankle sprain were evaluated with regard to lateral and syndesmotic ligament injury. As concomitant injuries the deltoid and spring ligaments, sinus tarsi, peroneal, flexor and extensor retinacula and tendons, traumatic bone changes and joint effusion were assessed. Six exclusive injury patterns were defined based on lateral and syndesmotic ligament involvement. Risk for associated injuries was estimated using logistic regression.
Results: Athletes were on average 22.5 years old and mean interval from injury to MRI was 5.7 days. 103 (39.5%) had a complete anterior talofibular ligament injury and no syndesmotic injury and 53 (20.3%) had syndesmotic involvement. Acute lateral osteochondral lesions of the talar dome were seen in 20 (7.7%) ankles and chronic lateral osteochondral lesions in 3 (1.1%). Risk for associated deltoid ligament injury was increased for ankles with lateral ligament injury (aOR 4.04, 95% confidence interval (CI) 1.99-8.22). Risk for talar bone contusions was increased for ankles with any syndesmotic injury (aOR 3.43, 95% CI 1.72-6.85).
Conclusion: About 20% of athletes referred for MRI after suffering an acute ankle sprain have evidence of syndesmotic injury, whilst about 40% have evidence of lateral ligament injury without syndesmotic involvement. Concomitant talar osseous and deltoid ligament injuries are common.

14:00 - 15:30 **Room E2**

GI Tract

SS 201b

Advances in small bowel imaging

Moderators:
P. Soyer; Paris/FR
V. Vandecaveye; Leuven/BE

B-0191 14:00

Dynamic contrast-enhanced magnetic-resonance imaging (DCE-MRI) of small bowel and MR flow analysis of mesenteric vessels in patients with Paroxistic Nocturnal Haemoglobinuria (PNH) with and without abdominal pain

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Purpose: We aimed to assess if DCE-MRI of small bowel wall and flow analysis of mesenteric vessels may identify early ischaemic signs in PNH patients, with (AP) and without (NAP) abdominal pain, which exact pathogenesis has never been determined by in vivo imaging studies.
Methods and Materials: Six AP and six NAP PNH-fasted patients were scanned using a 1.5 T MRI with a phased-array coil, after ingestion of PEG solution and during Gadobutrol i.v. injection. Mean flow (MF) and stroke volume (SV) of superior mesenteric vein (SMV) and artery (SMA) with ECG-gated phase-contrast flow-mapping sequences were assessed. Areas under the curve at 60 (AUC_{60}) and 90 seconds (AUC_{90}) and k-trans in six locations of

small bowel wall with perfusion sequences were calculated. Statistical analysis was performed with Mann-Whitney test.
Results: All the parameters above were lower in AP than in NAP: AUC_{60}: 84.81 1/s ± 4.99 vs. 131.73 ± 18.47; p = 0.002; AUC_{90}: 102.33 ± 5.76 vs. 152.58 ± 23.11; p = 0.002; k trans: 0.0240 ml / ml*min ± 0.0019 vs. 0.0369 ± 0.0009 (p=0.093 duodenum, 0.009 jejunum, 0.004 ileum). SMV: MF 4.67 ml/s ± 0.85 vs. 8.32 ± 2.14; p = 0.002; SV 3.85 ml ± 0.76 vs. 6.55 ± 1.57; p = 0.015. SMA: MF 6.95 ± 2.61 vs. 11.2 ± 2.32; SV 6.52 ± 2.19 vs. 8.78 ± 1.63; p = 0.065.
Conclusion: Small intestine blood-supply impairment could be an early and reliable MRI marker of mesenteric ischaemia in PNH patients with abdominal pain.

B-0192 14:09

Training readers to improve their accuracy in grading luminal Crohn's disease activity on MRI

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Purpose: To prospectively evaluate if training with direct feedback improves grading accuracy of inexperienced readers in determining luminal Crohn's disease activity on MR imaging.
Methods and Materials: Thirty-one readers (14 radiologists, 17 residents) without prior experience participated in a structured MR training program with individual hands-on training. All readers assessed 100 MR examinations of patients with Crohn's disease, randomly assigned to four sets of 25 cases and received direct feedback. An expert panel determined disease activity per case for determining the reference standard. To determine the effect of training with direct feedback, the proportions of grading accuracy, understaging and overstaging per set were compared using logistic regression analyses. Mean reading times and confidence scores (scale 0-10) were calculated and compared by t-test.
Results: Grading accuracy of all trainees was 51% (95%CI:41-60%), 60% (95%CI:51-69%), 63% (95%CI:52-72%) and 75% (95%CI:66-81%) in the four consecutive sets, respectively. Grading accuracy increased after 75 cases with direct feedback ($P < 0.001$). Understaging decreased, from 23% (95%CI:15-33%) to 7% (95%CI:3-14%) ($P < 0.001$). Overstaging did not change significantly.
The accuracy for grading none, mild, moderate and severe CD in the last set was 75% (95%CI:62-84%), 70% (95%CI:55-82%), 63% (95%CI:54-71%) and 87% (95%CI:62-96%), respectively. Mean reading time decreased from 6:37 to 4:35 minutes ($P < 0.001$). Mean confidence increased from 6.90 to 7.65 ($P < 0.001$).
Conclusion: Grading accuracy, reading time and confidence of inexperienced readers in evaluating Crohn's disease activity on MR improved during training with feedback. Inexperienced readers need training with at least 75 cases before achieving the accuracy as reported in literature.

B-0193 14:18

MR enterography in the study of patients with Crohn's disease: which findings of MRE are more likely to change the gastroentologist's management of the patient?

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Purpose: To determine which signs of Crohn's Disease (CD) on magnetic resonance enterography (MRE), are most likely to change patient-management.
Methods and Materials: Data on 63 CD patients were collected at McGill University Hospitals. 22 signs of CD were shown on MRE for these patients. Management post-MRE were stratified as: 1) no change, 2) change in medication dose, 3) change in medication, and 4) surgery and/or hospitalisation. Data concerning disease location, behaviour (Montreal CD classification), previous surgery and recent CRP prior to MRE were retrieved. Logistic regression (univariate/multivariate analyses) was used to determine which MRE and clinical signs were associated with management change.
Results: Of the 22 MRE signs, the most common were circumferential-wall-thickening (60.3%), and wall-enhancement post-Gadolinium (52.9%). 55.6% of patients had management changed (35 patients, with some overlap in groups 2.3,4) versus 44.4% with no change (group1). Logistic regression performed on clinical and MRE data showed: high CRP values, mesenteric engorgement, and bowel-wall-thickening had significant relationship with change of management vs. no change (group1). Circumferential-wall-thickening, and enhancement post-gadolinium had a significant relationship with change in medication (group3). Disease behaviour, CRP, tethering of bowel loops, spiculated mesenteric disease, and ileocolic disease were shown to have a significant relationship with the decision to perform surgery/hospitalise a patient (group4). Ordinate outcomes analysis, where the 4 different categories of management change were assumed to be different levels of change, showed patients with decreased motility to have higher odds of more severe change of management.
Conclusion: The information obtained here can guide radiologists as to which signs of CD are more important to look for on MRE from a patient-management perspective.

B-0194 14:27

Staging of Crohn's disease activity using CT, MRI, US and scintigraphy: a meta-analysis

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Purpose: To assess the role of computed tomography (CT), magnetic resonance imaging (MRI), ultrasonography (US) and scintigraphy (SG) in staging Crohn's disease (CD) activity.
Methods and Materials: MEDLINE, EMBASE and Cochrane databases were searched for studies evaluating CT, MRI, US and SG in staging CD activity as compared to (ileo)-colonoscopy or histology as the reference standard. Two independent reviewers assessed the data. Three by three tables (none, mild, frank disease) were constructed for all studies and overall diagnostic accuracies were calculated/summarised by fixed or random-effects models.
Results: Our search yielded 8347 articles, from which 20 articles were determined eligible for inclusion. A total of 577 patients were included. On per-patient basis: 2, 13, 1 and 1 datasets were available for respectively CT, MRI, US and SG. Data were not pooled for US and SG and showed accuracy values of 44% (95%CI:26-62%) and 40% (95%CI:12-74%) in the available datasets. CT and MRI data were pooled and showed similar overall grading accuracy estimates of 86% (95%CI:75-93%) and 84%(95%CI:68-93%), respectively (P=0.78). On per-segment basis: 2, 2, 2 and 3 datasets were available for respectively CT, MRI, US and SG. The overall grading accuracy estimates were respectively 74% (95%CI:68-80%), 78% (95%CI:72-82%), 66% (95%CI:52-78%) and 80% (95%CI:75-85%). US had the lowest accuracy. CT, MRI and SG had comparable accuracy ($P > 0.05$).
Conclusion: US has the lowest accuracy for grading CD. SG showed mixed results for per-patient and per-segment data. CT and MRI showed comparable high accuracy values both on per-patient and per-segment analysis.

B-0195 14:36

Does HRCT allow the prediction of oesophageal involvement in systemic sclerosis?

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Purpose: To correlate oesophageal diameters measured on CT with manometry-findings in patients with systemic sclerosis (SSC).
Methods and Materials: 148 patients with SSc underwent HRCT for SSc-assessment. From all patients information about dysphagia, dyspepsia, globus-sensation, odynophagia, heartburn, regurgitation was obtained. All patients fulfilling the ACR-Criteria, and underwent manometry were included (n=53, 41female, median-age 59, range 28-80). Based on manometry, two groups were defined (group1:pathologic manometry (n=39), group2: normal manometry (n=14)). Esophageal diameter,area and perimeter were measured by two independent readers on CT-images at following levels: largest diameter above and below the aortic arch, respectively on level of carina, pulmonalvenous confluens and 1 cm above right diaphragm. ROC-curves regression analyses were applied to correlate CT-measurements with manometry and clinical symptoms.
Results: Mean maximal diameter/area/perimeter was for group1 13.1 mm/106.8 mm2/36.2 mm (level of carina),11.6 mm/75.7 mm2/31.9 mm (level of pulmonalvenous confluens), 9.8 mm/77.9 mm2/27.8 mm (level 1 cm above right diaphragm) and for group2 7.5 mm/37.6 mm2/24.1 mm (level of carina), 11.1 mm/91.2 mm2/33.7 mm (level of pulmonalvenous confluens), 7.9 mm/66.7 mm2/26.9 mm (level 1 cm above right diaphragm). The largest mean diameter/area/perimeter above and below the aortic arch were 11.7 mm/101.2 mm2/33.7 mm and 17.0 mm/149.4 mm2/47.2 mm for group1 and 7.7 mm/34.6 mm2/21.5 mm, respectively 10.8 mm/59.6 mm2/28.7 mm for group2. The maximal diameters did not differ significantly between both groups. Interreader-variability was good (k=0.69). On level of carina, a cut-off perimeter of 31.2 mm allowed to differentiate between group1 and group2 with a sensitivity of 71% and a specificity of 87% (area under the curve 0.77). No correlations were found between CT-measurements and clinical findings. Significant correlations were found between CT-measurements and manometry on level of carina ($p \leq 0.02$) and below the aortic arch ($p \leq 0.01$).
Conclusion: HRCT allows to predict pathologic manometry-findings in patients with SSc using a cut-off perimeter of 31.2 mm on level of carina with a positive predictive-value of 98%.

B-0196 14:45

Small bowel motility measurements in MRI using 2D coronal slices: does the intrasegmental location matter? (a pilot study)

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Purpose: Small bowel motility analyses using dynamic MRI acquisition in coronal plane are of increasing clinical interest. The aim of this study was to evaluate if quantitative results of small bowel motility analyses in coronal plane are influenced by the positioning of the 2D cross-section measurement point within the small bowel`s lumen.
Methods and Materials: 44 small-bowel motility measurements in 6 participants (male; mean 37.8years) were included in this IRB approved, prospective study. MRI (3.0-T,Ingenia-Philips) was performed after standardised preparation. 3D-motility sequences (Dixon-dynFFE;TR 2.508;TE 11.254; slice thickness 3 mm; temporal resolution 1 sec) covering the ileocaecal region were acquired in breathhold over 42-56 sec. Motility was analysed measuring 2D cross-section diameters of the small-bowel lumen in three different locations (ventral, central and dorsal) of the same segment using a motility-assessment software. Curve characteristics (diameter, amplitude, extent of luminal occlusion during contractions) were compared for all three locations using ANOVA and paired student`s *t* test.
Results: Mean luminal diameter was 11.82 mm (SD±5.02) in the ventral, 13.49 mm (SD±4.44) in the central and 10.57 mm (SD±3.92) in the dorsal compartment of the bowel lumen without significant difference between the compartments ($p > 0.05$). Contraction amplitudes (ventral: 10.47 mm, SD±2.61; central: 10.89 mm, SD±2.93; dorsal: 10.55 mm,SD±3.21) did not differ ($p=0.878$) as well as the extent of luminal occlusion during the contractions ($p=0.11$) (ventral:0.97,SD±0.29; central:0.88,SD±0.28; dorsal:1.04,SD±0.25).
Conclusion: Quantitative motility parameters are not substantially influenced by the choice of cross-sections on the coronal planes as long as the segment is visible throughout the measurement.

B-0197 14:54

Is mesenteric panniculitis truely a paraneoplastic phenomenon? A matched pair analysis

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Purpose: Mesenteric panniculitis (MP) is an underdiagnosed inflammatory condition of mesenteric adipose tissue. Prior studies suggested an association of MP with malignancy. To reassess this hypothesis, we performed the first-matched case-control study comparing prevalence of malignancy and other disease in patients with and without MP.
Methods and Materials: With a keyword search, we identified CT examinations of MP patients between 2010 and 2012. Each MP patient was matched with two control patients for age, gender, abdominal diameter and CT protocol. Manifestation and extent of mesenteric panniculitis was classified independently by two investigators according to established criteria. Concomitant disease, laboratory parameters and follow-up CTs were recorded and analysed for all patients.
Results: 77 of 13485 CT patients were diagnosed with MP (prevalence 0.58%). 50.6 % of MP patients suffered from malignancy vs. 60.2% in the control group ($p = 0.157$). Over up to 4 years of follow-up in 35 of these 77 MP patients, no association between development of MP and the course of tumour diseases could be identified. There was also no significant difference in the rate of frequent concomitant diseases, such as hypertension, diabetes or previous surgery between the two groups.
Conclusion: In this first case-control study, we could show that, contrary to previous reports, mesenteric panniculitis is neither paraneoplastic nor it is associated with other diseases.

B-0198 15:03

Assessment of acute intestinal graft versus host disease by abdominal magnetic resonance imaging at 3 Tesla

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Purpose: After allogeneic stem cell transplantation (SCT) a reliable differentiation between acute graft versus host disease (aGvHD) and its differential diagnoses is essential for an early and successful treatment. Aim of this study is to assess intestinal aGvHD by magnetic resonance imaging (MRI).
Methods and Materials: As part of our routine preparation prior to allogeneic SCT 78 consecutive patients underwent abdominal MRI examination after informed consent on a 3 T MR-scanner (Magnetom Skyra, Siemens) including axial and coronal T2w sequences with and without fat-saturation and a three-dimensional dynamic T1w, contrast-enhanced sequence with a spatial resolution of 0.9x0.9x0.9 mm3. After SCT patients with suspected aGvHD received a second MRI as well as endoscopic examination with multiple biopsies for histologic investigation.
Results: Nine patients (aGvHD-group) suffered from histologically proven intestinal aGvHD. In ten control-group patients, no intestinal aGvHD was diagnosed. In all aGvHD patients characteristic MRI findings with long-segment bowel wall thickening - always involving the terminal ileum - with profound submucosal edema were detected. The bowel wall was significantly thickened in patients with intestinal aGvHD in comparison with control group patients (mean wall thickness of the small intestine: aGvHD-group 8 mm, control-group 3 mm, $p < 0.001$; large intestine: aGvHD-group 9 mm, control-group 3 mm, $p < 0.001$). Bowel perfusion spared the submucosa while demonstrating strong and patchy mucosal hyperemia. Free abdominal fluid was seen in the majority of aGvHD patients.
Conclusion: In intestinal aGvHD, a characteristic MR-appearance can be detected. This MRI pattern might facilitate an early and non-invasive diagnosis of intestinal aGvHD.

B-0199 15:12

Role of oral contrast medium in x-ray defecography

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Purpose: Oral contrast medium in x-ray defecography is not required in all procedures, but is mandatory to detect enterocele. To consider administering an oral contrast to all patients who undergo the procedure.
Methods and Materials: We reviewed our consecutive series of 139 procedures in last 4 years on patients suffering from disorders in the evacuation. For each procedure we have considered the presence or absence of enterocele and, if present, its extent. All our procedures were made with oral contrast medium administred to the patient one hour before the exam.
Results: 139 defecographies in 131 female patients and 8 male patients (mean age 61.6 years, median age 62 years) showed an amount of 52 enteroceles (37.4%), classed in 32 mild enteroceles (61.5 %, not interfering with the evacuation) and 20 severe enteroceles (38.5 %, interfering with the evacuation). No signifiant difference was recognised in efficacy between barium and iodinated contrast media.
Conclusion: The high rate of enterocele suggests the opportunity of use of an oral contrast in all patients who undergo defecography. The choice between barium and iodinated contrast media can be accomplished on the basis of the patient's clinical history.

B-0200 15:21

Prevalence of significant findings on magnetic resonance enterography (MRE) beyond Crohn's

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Purpose: Magnetic resonance enterography (MRE) is increasingly used for evaluation of the small bowel in patients with Crohn's disease. Occasionally other pathologies unrelated to Crohn's may be sought, or be identified when Crohn's is suspected. We aimed to determine the frequency of significant incidental findings detected by MRE in patients with suspected or known Crohn's disease, which may have important impact on clinical management.
Methods and Materials: Single centre study of 807 MRE performed between January 2004 and March 2013. Clinical details of study population and their respective MRE reports were obtained from local Computerised Radiology Information System and were retrospectively reviewed. Significant incidental findings were defined as enteric or extra-enteric findings unrelated to Crohn's that may account for presenting symptoms or requiring further investigation.
Results: Of 807 MRE, 98% were performed for suspected or known Crohn's. Only 2% were performed for more esoteric diagnosis particularly in young or pregnant patients. 38 (4%) of MRE had significant incidental findings, of which 58% (n=22) were bowel pathologies and 42% (n=16) were extra-enteric. Extra-enteric pathologies included gynaecological (n=7), mesenteric (n=3), urinary tract (n=2), biliary tree (n=1), neural crest (n=1), retroperitoneum (n=1), and vascular (n=1). Bowel findings were mainly of adhesion (23%), obstruction (18%), and intussusception (9%).
Conclusion: Although only a small proportion of patients have significant incidental findings at MRE, it is desirable that radiologists are aware of the MRE appearances of diseases affecting the small bowel other than Crohn's, and of extra-enteric diseases that may have similar clinical presentation to Crohn's.

14:00 - 15:30 **Room F1**

Oncologic Imaging

SS 216

New imaging biomarkers and decision-making in oncology

Moderators:
G.P. Schmidt; Munich/DE
C.A. Cuénod; Paris/FR

B-0201 14:00

Breast MRI as a potential biomarker to predict occurrence of metastasis: is there any additional value compared to classical prognostic factors?
M. Dietzel[1], R. Zoubi[2], C. Jerowski[3], W.A. Kaiser[3], P.A.T. Baltzer[4];
[1]*Erlangen/DE, Jena/DE*, [2]*Bielefeld/DE, Jena/DE*, [3]*Jena/DE*, [4]*Vienna/AT, Jena/AT*

Purpose: There is increasing evidence that breast-MRI could be used as a non-invasive prognostic-biomarker. However, most previous investigations addressed surrogates of outcome as endpoint, i.e. tumour-grading, steroid-receptors, etc., instead of direct endpoints such as distance-metastasis. Furthermore, the additional value of breast-MRI compared to classical prognostic-factors remains poorly investigated. Accordingly, we aimed to investigate the additional value of breast-MRI compared to conventional prognostic-factors to predict occurrence of distance metastasis.
Methods and Materials: Patients with newly diagnosed invasive breast cancer receiving pre-therapeutic breast-MRI at our institution were eligible (standardised protocol according to EUSOBI-recommendations; 1.5 Tesla). Classical prognostic-factors included nodal-status, T-stage, typing, tumour-grading, in situ components, steroid-receptors and herceptin-receptor-status. All patients were followed-up according to national-guidelines and occurrence of distant-metastasis was documented. Breast-MRI was analysed semi-automatically by a commercial CAD-system (computer-assisted-diagnosis). It allows to semi-quantitatively assess characteristic enhancement-parameters (n=15) of the breast-cancer. Logistic-regression was used to identify accuracy of classical prognostic-factors *alone* and *in combination* with breast-MRI to predict occurrence of distant-metastases (ROC: receiver-operating-characteristics; AUC: area-under-the-ROC-curve; inter-AUC-comparison).
Results: During a mean follow-up of 55 months, 38 out of 251 women (15.8%) were diagnosed with distant-metastasis. If used separately, breast-MRI (AUC=78.8%) and classical prognostic-factors (AUC=80.0%) showed moderate accuracy to predict distant-metastases without significant difference (P=0.8). Yet, the combined use of breast-MRI and classical prognostic-factors significantly increased overall accuracy to AUC=87.1% ($P < 0.001$).
Conclusion: Breast MRI has a major potential as a non-invasive biomarker. According to our data it adds significant prognostic value to classical prognostic factors to predict distance metastasis in breast cancer.

B-0202 14:09

Comparison between MRI and CT in prediction of peritoneal carcinomatosis index in patients undergoing peritoneal surgery in relation to the radiologist's experience
M. Torkzad[1], N. Casta[2], A. Bergman[2], H. Ahlström[2], H. Mahteme[2];
[1]*Sollentuna/SE*, [2]*Uppsala/SE (michael.torkzad@gmail.com)*

Purpose: To compare CT and MRI for assessment of total PCI and tumour burden per site and assessments made by the radiologists.
Methods and Materials: In 19 prospective cases of peritoneal carcinomatosis, MRI of the abdomen (with T1-weighted TSE, T2-weighted TSE, 3D T1-weighted fat saturated images before and contrast enhancement with Gd, and diffusion-weighted images with b 1000) and contrast-enhanced CT (portal venous phase) was used within two days and maximum one week before surgery. An inexperienced radiologist and an experienced (MRI and CT) abdominal radiologist evaluated the images separately on different occasions and blinded to clinical data. The agreement between the radiologists' assessment and surgical findings in total and per site were measured and compared.
Results: Total PCI: experienced radiologist assessed total tumour burden correctly on both CT and MRI (kappa = 1.0). The inexperienced radiologist assessed CT better (kappa = 0.73) than MRI (kappa = 0.58). Different sites: Experienced radiologist showed higher agreement per location with kappa = 0.77 for MRI and 0.80 for CT. The same figures were 0.39 and 0.60 for the inexperienced radiologist. The best results of experienced radiologist for assessment of the small intestine and its mesentery were seen with CT while for pelvis, upper abdomen and the flanks the best agreement was seen on MRI.
Conclusion: Degree of experience influences assessment of PCI more than choice of modality. The difference between CT and MRI results is partially related to experience and tumour site for the inexperienced radiologists.

B-0203 14:18

Remaining malignant lymph nodes in good responders after chemoradiotherapy for rectal cancer: where are they located?
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Purpose: Minimally invasive treatments may be an option in rectal cancer patients showing a good or complete tumour response after chemoradiotherapy (ypT0-2). However, regardless the primary tumour response, remaining metastatic lymph nodes withhold a risk for recurrence. Knowledge on the presence and location of these ypN+ nodes may help guide treatment intensification (boost radiotherapy) to further sterilize the nodes. Aim of this study was to investigate location patterns of remaining ypN+ nodes in good/complete tumour responders.
Methods and Materials: 211 locally advanced rectal cancer patients underwent chemoradiotherapy, which resulted in downstaging to ypT0-2 in 134 patients, who constituted the final study group. For the patients with a ypT0-2N+ status, a lesion-by-lesion MR-histologic analysis was performed on the location of the individual ypN+ nodes.
Results: 8/134 ypT0-2 patients (6%) had a yp2N+ status. 47% of the ypN+ nodes were located at the same height as the tumour, the other 53% were located proximal to the tumour at a distance of 1.2-6.5 cm above the tumour level (40% within < 5 cm from the tumour; 60% > 5 cm above the tumour, in the presacral area). In the axial plane, 71% of the nodes were located near (within < 1 cm from) the tumour/rectal lumen.
Conclusion: The incidence of remaining malignant nodes in case of good tumour response after CRT is very low. Remaining nodal metastases are solely located at the same level or proximal to the tumour. The majority of N+ nodes are located near the tumour/lumen.

B-0204 14:27

Preoperative evaluation of rectal cancer with MR: how to increase diagnostic accuracy of N staging?
M. Gatti, R. Faletti, M. Benedini, S. Stola, A. Rapellino, A. Dominguez, A. Grasso, P. Fonio, G. Gandini; *Turin/IT (marcogatti17@gmail.com)*

Purpose: To evaluate the accuracy of magnetic resonance (MR) on loco-regional staging of rectal cancer focus on nodes, and compare the results to histologic findings, considered as standard reference.
Methods and Materials: Between July 2011 and March 2013, 61 patients, 31 (52.5%) males, age 66.75±13.77, with rectal cancer, were staged preoperatively with MR and had surgical resections performed. Two radiologists blinded to the pathology results performed the MR evaluation independently. Nodal size, border contour, signal intensity and localisation were considered on 265 nodes for N malignant score (p1, p2, p3). The ADC values of N were measured in regions of interest. Comparison between imaging and histopathologic findings was carried out with different approaches: Chi-square test, analysis of variance (ANOVA), Kruscal-Wallis' test, Cohen's kappa coefficient and ROC curve.
Results: MR accuracy for T-stage was Kw= 0.87±0.06, interoperator variability was not statistical significant (Kw=0.62±0.08). Nodes were divided into p1=198, p2=17, p3=50. Accuracy on node defined suspicious (p3) was kw=0.62±0.08. ADC values for nodes were p1=1.227±0.298 mm2/s, p2=1.120±0.306 mm2/s and p3=0.818±0.168 mm2/s. We defined a threshold ADC value of 1 mm2/s and the correlation with malignant node was strong (AUC=0.88). The percentage of malignant nodes [p3/(p1+p2)] is higher in the external iliac lymph nodes than pre-sacral and meso-rectal ones (55.6% vs. 17.5 and 17.6%).
Conclusion: Magnetic resonance imaging is an accurate imaging method in staging of rectal cancer. Prediction of nodal involvement could be improved using ADC value, which is a reliable and reproducible evaluation.

B-0205 14:36

Pre-operative MRI in early stage cervical cancer may predict the need of adjuvant therapies: a single-center experience
S.A. Angileri, S. Rizzo, S. Maccagnoni, G. Calareso, F. Landoni, S. Raimondi, E. Pasquali, R. Lazzari, M. Bellomi; *Milan/IT (ang.alessio@yahoo.it)*

Purpose: To determine whether MRI and DWI may predict which patients are candidate to adjuvant therapies in early-stage cervical cancer.
Methods and Materials: Data about adjuvant therapies, minimum uninvolved stroma, maximum stromal involvement, positive lymph nodes were collected in 217 patients operated for early-stage cervical cancer (FIGO IA1-IIB). ADC maps were avaible in 51/217 patients. Measures from pathological reports were used as reference standard. P-values < 0.05 were considered significant.
Results: 113/217 (54%) patients underwent adjuvant therapies (9 chemotherapy; 21 radiotherapy; 83 radio-chemotherapy). Sensitivity,

specificity, positive/negative predictive values and accuracy of MR imaging in evaluating minimum thickness of uninvolved cervical stroma were respectively 88%, 75%, 70%, 90% and 80% while for pelvic positive lymphnodes were 64%, 85%, 65%, 84% and 78%. MR and pathological results were concordant about maximum depth of stromal invasion in 207/217 patients (95%). Depth of stromal invasion was strongly related to positive nodal status ($p < 0.001$). DWI showed no correlation with histological type, grade or presence of lymph node metastasis.
Conclusion: Pre-surgical MR evaluation can predict the need of adjuvant therapies because of the high accuracy in measuring the minimum thickness of uninvolved stroma and the maximum depth of stromal invasion. MR accuracy in detection of positive lymph nodes was 78%. Depth of stromal invasion was strongly related to the presence positive lymph nodes.

B-0206 14:45

Five-year results of prostate cancer permanent brachytherapy: the importance of postimplant CT-based quality control
O. Apolikhin, A. Sivkov, B. Oschepkov, D. Roshin, A. Koryakin; *Moscow/RU (vatatava@ya.ru)*

Purpose: Brachytherapy is a high-tech method, which arose from Radiology and Minimally Invasive Urology as the result of the accumulation of significant experience in radiation therapy and the latest knowledge of radiation biology and dosimetry. However, the real seed distribution doesn`t always match the preplan. The main purpose of the study was to asses the long-term results depending on the postimplant dosimetry.
Methods and Materials: Single-centre results of brachytherapy with 125I sources in 117 prostate cancer patients of low and intermediate-risk group (according to the D `Amico criteria) with an average follow-up of 5 years, operated in FSBI Institute of Urology from 2000 to 2013. In the postoperative period (on the 30th day) patients underwent CT-based PDA (postimplantation dosimetric analysis), which restated the basic dosimetric parameters - one of the most important - D90 (dose that is received by 90% of the prostate gland).
Results: According to our data, the 5-year disease-free survival was significantly higher in the patients who received radiation dose D90> 140 Gy, than in patients with dose < 140 Gy: 93.2% and 77.6%, respectively (p 140 Gy), but statistically significant differences between the groups were obtained only in the incidence of dysuria: 58.6% and 42.4%, respectively ($p < 0.05$).
Conclusion: Along with the stage of disease, tumor grade, and preoperative PSA, PDA plays important role in the prognosis of the disease. In patients with higher D90 biochemical control was better, although the frequency of dysuria in this group of patients was more common.

B-0207 14:54

Ionizing radiation exposure as a result of diagnostic imaging in patients with Hodgkin and non-Hodgkin lymphoma
M.P. Crowley, S.B. O'Neill, D.C. O'Neill, B. Bird, O. Flanagan, M.M. Maher, M.R. Cahill, D. O'Shea, K. O'Regan; *Cork/IE*

Purpose: Exposure to ionizing radiation has been linked to an increased risk of malignancy. An increasing majority of patients with lymphoma achieve long-term survival. Late complications of treatment have emerged as a significant cause of death/morbidity. Long-term survivors are at risk for developing second malignancies due to treatment. Ionizing radiation exposure through diagnostic imaging may increase this risk.
Methods and Materials: Retrospective review of 486 consecutive patients with biopsy-proven Hodgkin/non-Hodgkin lymphoma that discussed at a multidisciplinary lymphoma meeting between January 2009 and July 2012 was conducted. The number/type of radiological procedures were obtained from the radiology databases in each of 5 participating centres. The cumulative effective dose (CED)was calculated using standardised procedure-specific radiation dose levels.
Results: Mean (SD) age at diagnosis was 59 (17) with 15% (n=73) under 40 years. 59% percent were men. 16% (n=78) had Hodgkin lymphoma; 84% (n=408) had Non-Hodgkin lymphoma. The median estimated total CED (IQR) per subject was 69.4mSv (42-118). 46% had a total CED > 75mSv and 14% had a total CED > 150mSv. CT contributed 89% of the CED and PET-CT contributed 8%. Patients aged under 40 had a median (IQR) CED of 89.44mSv (55.42-123.94). Patients who underwent a stem cell transplant had a median (IQR) CED at 161.94mSv (135.11-224.68). 59% of this group went on to have radiotherapy as part of their treatment protocol.
Conclusion: This study highlights the considerable ionizing radiation exposure from radiological imaging in lymphoma patients, especially in young patients considered the most radiosensitive and at highest risk for secondary malignancies.

B-0208 15:03

The role of baseline 18 F-FDG PET/CT maximum SUV in predicting treatment outcome of patients with multiple or oligometastatic breast cancer
H. Zagloul[1], Y. Assiri[1], Y.E. Almalki[2], S. El badawy[1]; [1]*Dammam/SA*, [2]*Riyadh/SA (yaser_21@yahoo.com)*

Purpose: To evaluate pretreatment (SUVmax) of (18 F-FDG PET-CT) as a predictor of progression free survival (PFS), and overall survival (OS) in multiple and oligometastatic breast cancer patients.
Methods and Materials: We retrospectively analysed metastatic breast cancer patients (MBC) who had pretreatment 18 F-FDG PET-CT from January 2010 to December 2012. We examined the association between the highest pretreatment (SUVmax) in metastatic sites and the treatment outcomes. The (PFS), and (OS) were calculated by the Kaplan-Meier method, and log rank test.
Results: We identified 70 MBC patients with pretreatment 18 F-FDG PET-CT. Oligometastasis to bone was observed in 20 patients while 50 patients had multiple organs metastases. The receiver-operating characteristic curve (ROC) demonstrated a SUVmax 7.7 to be the cutoff in multiple MBC for predicting PFS which was significantly higher in patients with pretreatment SUVmax ≤ 7.7 compared to > 7.7 ($P < 0.0001$). On multivariate analysis (MVA), the SUVmax category was the only factor correlated with both PFS (Hazard ratio (HR)) = 4.5, 95% C I 3-6.8, $P < 0.0001$) and OS (HR = 3.2, 95% C I 2.2-4.9, $P < 0.0001$). Additionally, the ROC cut off SUVmax in oligometastatic patients was 4.4 with significantly higher PFS in patients SUVmax ≤ 4.4 compared to > 4.4 ($P = 0.001$). On MVA, the SUVmax category was the only factor associated with PFS ((HR) = 8.4, 95% C I 1.2-54.8, $P < 0.026$) and but not OS ($P = 0.99$).
Conclusion: The pretreatment 18 F-FDG PET-CT SUVmax is an independent prognostic predictor of clinical outcomes in MBC patients.

B-0209 15:12

The malignant proliferation of MDT meetings: can radiology departments continue to support them all?
R. Balasubramaniam, M. Subesinghe, J. Smith; *Leeds/UK (ravivarmabalasub@gmail.com)*

Purpose: To quantify the increase in workload associated with multidisciplinary team meetings for radiologists working in a tertiary referral centre over a 5-year period.
Methods and Materials: Information regarding volume of MDT cases from 2008 to 2012 was acquired from the radiology information system (CRIS™) and through structured interviews of individual consultant radiologists. Data obtained included the number of MDT meetings involved with, type of MDT meeting (oncological or non-oncological), time allocated for preparation and perceived deficiencies in the current MDT meeting.
Results: The annual number of cases discussed in an MDT meeting in 2008 was 13049. In 2009, this had grown to 24610, by 2010 it was 26864, in 2011 a peak of 28603 cases and in 2012 there were 26984 entries. This demonstrates that the volume of cases has more than doubled over five years. Consultant radiologists were responsible for a median of 2 MDT meetings per week (range 1-5). 66% (31/47) of consultant radiologists were part of an oncological MDT meeting and 60% (28/47) prepared for at least part of their MDT meeting out of contracted working hours. The most frequently stated deficiencies in the current MDT meeting included insufficient clinical information (40%) and a lack of clerical support/funding (32%).
Conclusion: The MDT approach is the standard of care in the delivery of optimal oncological patient management in the UK. The radiologist's workload associated with MDT meetings has more than doubled in the last 5 years. The MDT meeting is under resourced and without change unsustainable.

B-0210 15:21

Multidisciplinary meetings and radiologist workload: a retrospective and prospective review in a tertiary university centre in Ireland
E. Aherne, H. Moriarty, M. Egan, L. Lawler; *Dublin/IE (emily.aherne@gmail.com)*

Purpose: In recent years multidisciplinary meetings (MDMs) have become a part of the standard of care for many patients with cancer. The number and complexity of imaging studies presented continues to expand rapidly. These meetings are an important forum for discussion and decision-making regarding challenging cases and for clinical teaching but have put increasing pressure on radiology departments in their demand for time and resources.
Methods and Materials: Data was retrospectively gathered from April 2012 to September 2012 regarding the number of MDMs held and type of imaging reviewed. A five-week prospective study was performed from 22/10/2012 to 25/11/2012 inclusive to examine the workload in further detail.
Results: Retrospectively, 199 meetings were held with 2253 clinical cases reviewed over 26 weeks. Prospectively, 52 meetings were held over 5 weeks

for 13 clinical specialty areas. There were 1038 clinical case discussions. There were a total of 2122 documented individual imaging studies reviewed: 563 CT studies (27%), 446 ultrasound studies (21%), 411 mammogram studies (19%), 264 MRI studies (12%), 113 PET studies (5%). Specialist registrar preparation time was 55 hours (11 per week). Consultant preparation time was 67.75 hours (13.55 per week). Delivery time was 57.25 hours (11.45 per week).
Conclusion: MDMs are becoming a standard of care for cancer patients. Due to the rapid increase in the number of meetings and the volume and complexity of cases discussed, MDMs now represent a significant proportion of the radiologist workload and reduce the time dedicated to other activities within the department.

14:00 - 15:30 **Room F2**

Breast

SS 202
Different ways to evaluate treatment response

Moderators:
P.A.T. Baltzer; Vienna/AT
G.I. Kirova-Nedialkova; Sofia/BG

B-0211 14:00

Evaluation of T1/T2 ratios obtained by quantitative MRI in a pilot study as a potential biomarker to monitor response to treatment of biopsy-proven malignant breast lesions and assessment tool for involvement of contralateral breast.
M.A. Malikova[1], J.N. Tkacz[1], A. Aakil[1], P.J. Slanetz[1], C.-Y. Guo[2], H. Jara[1], C.-Y. Guo[2]; [1]*Boston, MA/US*, [2]*Tainan/TW (mmalikov@bu.edu)*

Purpose: To study a potential role of quantitative MRI (qMRI)using T1/T2 ratios to assess contralateral breast involvement and monitor response to treatment.
Methods and Materials: In a pilot study, 28 women with known breast lesions were scanned post-treatment with the mixed-TSE pulse sequence and T1/T2 maps were obtained. qMRI assessment of contralateral breast without known cancerous lesion was performed and compared to the breast lesion subjected to chemotherapy and/or radiation therapy to monitor treatment response.
Results: T1/T2 means of 6.73 ± 2.55 were observed for biopsy-proven malignant lesions treated prior to qMRI with chemotherapy and/or radiation as compared to contralateral breast with T1/T2 ratio means of 3.37 ± 1.68. Recurrent disease with contralateral breast involvement was confirmed by histophatology in two cases and elevated T1/T2=11.5 for previously treated lesion (contralateral breast T1/T2 = 8.1) and T1/T2= 9.1 (contralateral breast T1/T2= 6.9) were detected. The higher stage of cancer determined by histopathology was strongly associated with higher T1/T2 ratio (p= 0.0093). Estrogen, progesterone and HER2/neu receptors triple-negative status were associated with higher T1/T2 ratio and more poor response to treatment (p=0.0065). Larger size of lesion showed significant correlation with elevated T1/T2 ratio and poor response to treatment with chemotherapy alone (p=0.0427) as compared to combination regimen with chemotherapy and radiation.
Conclusion: The T1/T2 ratios provide measures that strongly correlate with histopathology. This quantitative information can provide basis for improvement of diagnostic breast imaging and serve as a tool to assess response to treatment and contralateral breast involvement.

B-0212 14:09

Role of pre-treatment apparent diffusion coefficient in the prediction of response to neoadjuvant chemotherapy in locally advanced breast cancer patients
A. Cipriani, E. Bufi, P. Belli, M. Costantini, M. Di Matteo, P. Rinaldi, L. Bonomo; *Rome/IT (antocipriani@tiscali.it)*

Purpose: Being still no consensus in the literature about this topic, we addressed the diagnostic reliability of apparent diffusion coefficient (ADC), obtained before treatment, in the prediction of response to neoadjuvant chemotherapy (NAC) in locally advanced breast cancer (LABC) patients.
Methods and Materials: Two hundred fifty-five consecutive LABC patients (mean age 47.7±10.0 years, range 24-74 years) underwent a 1.5 T MRI examination of the breast before and after NAC, prior to surgery, including dimensional assessment of target lesions (according to RECIST criteria) and diffusion-weighted imaging (DWI), with ADC calculation (b values 0 and 1000 sec/mm^2). Response to treatment was assessed according to the TRG (tumour regression grade) classification. Pre-treatment ADC and increase in ADC values (ΔADC) following NAC of responders and non-responders were compared.
Results: Following NAC, pathological complete response (TRG1) was observed in 17% of cases, partial response (TRG2-3) in 42% and no response (TRG4-5) in the remaining 41%. ADC was capable of differentiating each specific tumour subtype before treatment (anova, p=0.022). No difference was observed between pre-treatment ADC of patients with partial or complete response to treatment (TRG1-2-3) and non-responders (TRG4-5, p=0.581). Otherwise, post-treatment ADC of responders was statistically higher than non-responders ($p < 0.001$). Both final ADC and ΔADC inversely correlated with the TRG class (Spearman's rho -0.373 and -0.315, respectively, $p < 0.001$).
Conclusion: In our experience, pre-treatment ADC does not predict response to NAC in LABC patients. Otherwise, final ADC and ΔADC negatively correlate with response to treatment and should be taken into consideration when establishing it.

B-0213 14:18

Diffusion-weighted imaging to quantify the residual tumour post-neoadjuvant chemotherapy in locally advanced breast cancer: in comparison with dynamic contrast-enhanced MRI
S. Poyyamoli; *Coimbatore/IN (psan26@yahoo.co.in)*

Purpose: Quantification of breast carcinoma after neoadjuvant chemotherapy is essential to triage a locally advanced breast cancer (LABC) patient into breast conservation. Diffusion-weighted imaging (DWI) is evaluated for residual tumour assessment in comparison with dynamic contrast-enhanced MRI (DCE MRI).
Methods and Materials: Thirty-six patients with LABC were studied with DWI and DCE MRI, before and after neoadjuvant chemotherapy. Tumour size and Apparent Diffusion Coefficients (ADC) were recorded. The residual tumour sizes measured at DWI and DCE MRI were compared with the size at post-surgical pathology, which was considered gold standard, using Pearson correlation. The pre-treatment ADCs of the tumour were compared between those with pathological complete response (pCR) and those with residual disease (non-pCR).
Results: The sensitivities and specificities for detection of residual tumour were similar for both DWI and DCE MRI, at 100% and 80%, respectively. Both DWI ($r=0.94$, $p < 0.001$) and DCE MRI ($r=0.93$, $p < 0.001$) had significant correlation with tumour size at pathology with no significant difference between their strengths of correlation (z=0.12, p=0.9045). DW MRI (z=0.797, p=0.425) and DCE MRI (z=0.88, p=0.379) fared equally well among focal and nonfocal lesions. There was no significant difference (p=0.5527) in the pre-treatment ADCs between the pCR and non-pCR groups.
Conclusion: DWI is as accurate as DCE MRI in quantifying the presurgical residual disease in patients with locally advanced breast cancer who undergo neoadjuvant systemic therapy. It can be of use in patients with end-stage renal disease. ADC analysis is not useful in tumour response prediction.

B-0214 14:27

The hypervascularity paradox: can asymmetric increase in breast vascularity predict the response of neoadjuvant chemotherapy and the follow-up outcome in locally advanced breast cancer?
M. Di Matteo, E. Bufi, A. Cipriani, M. Costantini, P. Belli, L. Bonomo; *Rome/IT*

Purpose: To investigate the relationship between asymmetric increase in breast vascularity (AIBV) and the pathological and molecular profiles of breast cancer. To address the prognostic performance of AIBV and of vascular maps reduction after NAC (Neoadjuvant Chemotherapy) in predicting pathological complete response (pCR) at surgery and outcome at follow-up.
Methods and Materials: Two-hundred-nineteen patients with unilateral locally advanced breast cancer (LABC) underwent MRI before and after NAC. Axial, sagittal and coronal MIPs were obtained to allow a subjective comparative evaluation. Asymmetrical vs. symmetrical breast vascularity was defined through a combination of vessels number, diameter and signal intensity. An average 31.4 ± 18 months follow-up was available for 82 patients.
Results: AIBV ipsilateral to the LABC was observed in 62.5% of cases ($p < 0.001$). AIBV was also significantly associated with IDC, G3, Triple Negative, HER2+, and Hybrid phenotypes ($p < 0.001$). pCR was higher among the LABC with ipsilateral AIBV (24%) than those with symmetrical breast vascularity (6%) (p= 0.001; t=-3.395). After NAC, vascular map in the breast with LABC was significantly reduced, particularly in patients with pCR ($p < 0.001$; t=-4.803). At follow-up, a 22% recurrence-rate was observed (6.1% mortality). AIBV after NAC was significantly associated with worse overall survival at follow-up (Kaplan-Meier analysis).
Conclusion: LABC with ipsilateral AIBV before NAC is associated with more aggressive clinical, pathological and molecular profiles. Nonetheless, it is more sensitive to NAC and shows a higher frequency of pCR. Consistently, the presence of AIBV after NAC entails a worse late prognosis and should prompt more aggressive therapeutic strategies.

B-0215 14:36

Accuracy of 3 T magnetic resonance imaging (3 T MRI) with a high-relaxivity contrast agent in assessing treatment response in patients undergoing neoadjuvant chemotherapy (NAC)

M. Telesca, F. Pediconi, S. Ursu, M. Luciani, V. Casali, E. Miglio, C. Catalano; *Rome/IT (marianna.telesca@uniroma1.it)*

Purpose: To assess the accuracy of 3 T MRI in evaluating residual disease after NAC in patients with advanced breast cancer.
Methods and Materials: Between March 2010 and March 2013, 47 women with advanced breast cancers underwent 3 T MRI before and after NAC. The MRI protocol comprised precontrast FSE T2w IDEAL sequence and VIBRANT 3D T1w sequence acquired before and after administration of gadobenate dimeglumine (MultiHance®) at 0.1 mmol/kg bodyweight. Tumour size was determined before and after NAC. MRI evaluation of treatment response was classified with RECIST criteria. Pathologic complete response was defined as when there were no residual invasive cancer cells. Residual tumour size at MRI was compared with pathological findings.
Results: 50 lesions were evaluated. The overall sensitivity, specificity, PPV, NPV and accuracy for diagnosing of invasive residual disease at MRI were 70%, 76%, 85%, 57% and 72%, respectively. The presence of residual tumour at MRI was overestimated in 4 cases (in 2 cases histology showed only DCIS component) and underestimated in 10 cases (histology showed scattered residual invasive foci). We found a statistically significant correlation between MRI and pathology measurements (Spearman Rho = 0.639; P value < 0.0001). The tumour size was underestimated in 11 cases, in all of these the histological size was less than 4 mm.
Conclusion: The presence and size of residual disease in breast patients treated with NAC could be accurately evaluated using 3 T MRI and high-relaxivity contrast agent. Both overestimation and underestimation can be observed and might have important clinical impact.

B-0216 14:45

Locally advanced breast cancer response to neoadjuvant chemotherapy: correlation between RECIST, positive enhancement integral values and tumour vascularity

M. Nadrljanski, R. Maksimovic, V. Plesinac-Karapandzic, M. Nikitovic, B. Markovic-Vasiljkovic, Z. Milosevic; *Belgrade/RS (dr.m.nadrljanski@gmail.com)*

Purpose: To prospectively assess tumour size, vascular score, positive enhancement integral (PEI) on MRI and their correlation in patients with locally advanced breast cancer (LABC).
Methods and Materials: Thirty patients were assessed initially, after four cycles of anthracycline-based regimen and upon NACT (paclitaxel, 4 cycles) with 1.5 T unit, on Gd-DTPA postcontrast series. The following was analysed: tumour size (RECIST), number of vessels (30 mm or longer, 2 mm or larger) and PEI values (mean±SD), correlated to RECIST.
Results: Tumour size change is significant before and after four cycles (4.7±1.5 cm vs. 3.2±1.1 cm, $p < 0.001$) and upon NACT (4.7±1.5 cm vs. 1.9±0.9 cm, $p < 0.0001$). The same applies to vascularity after four cycles (4.0±1.1 vs. 3.2±1.1, $p < 0.001$) and upon NACT (4.0±1.1 vs. 2.2±0.9, $p < 0.0001$) and to PEI after four cycles (779.6±97.2 vs. 662.6±91.3, $p < 0.001$) and upon NACT (779.6±97.2 vs. 566.2±97.1, $p < 0.0001$). The correlation between RECIST and vascularity/PEI is weak after four cycles (0.36 and 0.22 respectively) and moderate upon NACT (0.61 and 0.50 respectively). Upon NACT, the correlation between vascularity and PEI is weak (0.33), unlike the strong correlation of tumour size after four cycles and upon NACT (0.80).
Conclusion: Tumour size, vascularity and PEI significantly change during and upon NACT. Change in tumour size after four cycles and upon NACT strongly correlates. There is moderate positive correlation between RECIST and vascularity/PEI upon completion of NACT, but not before paclitaxel was introduced. To our knowledge, this is the first trial testing PEI in NACT.

B-0217 14:54

Breast MRI: factors affecting accuracy in the evaluation of residual disease after neoadjuvant chemotherapy

S. Gigli, F. Di Pastena, S. Tardioli, M. Mancini, G. D'Amati, M. Monti, L. Ballesio; *Rome/IT (adrenalina_1@hotmail.it)*

Purpose: After Neoadjuvant Chemotherapy (NACHT)some changes occur in the tumoral bed,reducing MRI accuracy in evaluating residual disease.We aimed to analyse the causes of under/overestimation of lesions size in MR images.
Methods and Materials: We reviewed MRI exams of 69 patients with locally advanced breast cancer and we measured the longest diameter of each lesion on MR images obtained before and after NACHT.The response rate was expressed in percentage and compared to the tumor size on the histological specimen (expressed in percentage according to Miller and Payne).In absence of residual tumor we classified the case as pathological complete response (pCR). We used Pearson correlation and T-test to relate MRI and pathological response rate.We stratified differences based on the histological changes in the surgical specimen (fibrosis or necrosis).We also considered MRI findings (mass/non mass like enhancement, high T2 signal intensity) and tumor biological features.
Results: 23/69 patients achieved pCR.MRI identify pCR in 21/23 cases,in two cases overestimate disease.We observed a good correlation (0.67)between MRI and pathology (t=6.1169; df =46; $p < 0.005$).In the other cases MRI overestimates the residual lesions.Size discrepancy was greater in case of diffuse fibrosis on the surgical specimen.Other causes were large lesions (> 2.5 cm),non mass-like enhancement,Triple Negative cancers and high T2 signal intensity.
Conclusion: MRI is a valid tool in evaluating pCR but tends to overestimate lesions size in case of residual tumor.MRI accuracy in estimating tumor size after NACHT depends on the presence of fibrous tissue,still vascularised,which can enhance after contrast.It's very important to consider tissue changes caused by chemotherapy in order to improve MRI accuracy.

B-0218 15:03

Role of MRI in predicting the response of neoadjuvant chemotherapy and the follow-up outcome in patients with different breast cancer phenotypes

E. Bufi, M. Di Matteo, P. Belli, L. Nardone, B. Diletto, L. Bonomo; *Rome/IT*

Purpose: We addressed the diagnostic reliability of conventional MRI vs. Diffusion Weighted Imaging (DWI) according to different tumor subtypes, including HER2+/HR+ (Hybrid phenotype) and in the prediction of outcome at follow-up.
Methods and Materials: Two-hundred-twenty-five patients underwent MRI before and after NAC, including morphological assessment (RECIST classification) and DWI with ADC. The complete pathological response - pCR was assessed (Mandard classification). An average 31.4 ± 18 months follow-up was available for 82 patients.
Results: Tumor phenotypes were Luminal (63.6%), Triple Negative (16.4%), HER2+ (7.6%) or Hybrid (12.4%). After NAC, pCR was observed in 17.3% of cases. Average ADC was statistically higher after NAC ($p < 0.001$) among patients showing pCR vs. those who had not pCR. The RECIST classification showed adequate performance in predicting the pCR in Triple Negative (area under the ROC curve, AUC=0.9) and in the HER2+ subgroup (AUC=0.826). Less accurate performance was found in the Luminal and Hybrid subgroups (AUC 0.693 and 0.611, respectively). In the latter two, the ADC criterion yielded an improved performance (AUC=0.787 and 0.722, respectively). At follow-up, a 22% recurrence-rate was observed (6.1% mortality); no recurrence was observed among pCR patients. None of the above-mentioned MRI criteria predicted disease-free survival (Kaplan-Meier survival analysis).
Conclusion: The diagnostic reliability of MRI in predicting the pCR to NAC depends on the tumor phenotype, particularly in the Luminal and Hybrid subgroups. In these cases, the ADC value may facilitate the diagnosis. Nonetheless, disease-free survival at follow-up can be predicted through final histopathological results only.

B-0219 15:12

MRI evaluation for residual diseases after the lumpectomy of malignant breast tumours

L. Wang, D. Wang; *Shanghai/CN (wangjun.124@163.com)*

Purpose: To determine the utility of breast magnetic resonance imaging (MRI) in detecting residual diseases at the prior lumpectomy site.
Methods and Materials: From September 2009 to June 2013, 87 consecutive patients who underwent lumpectomy and were pathologically confirmed as malignant tumours were retrospectively reviewed. All the patients underwent MRI before re-excision surgery. All scans were evaluated according to BI-RADS criteria of MRI for post-surgery.
Results: Of the 87 patients, residual diseases were pathologically confirmed in 28 (32.2%) patients. Forty-two patients had BI-RADS 2 or 3 category, among of which, 4 (9.5%) had residual lesions and 50% (21/42) patients had undergone breast conservation therapy; Forty-five patients had BI-RADS 4 or 5 category, among of which, 24 (53.3%) had residual lesions and 8.9% (4/45) patients had undergone breast conservation therapy. The sensitivity, specificity, positive predictive value and negative predictive value of MRI for prediction of residual cancer were 85.7% (24/28), 64.4% (38/59), 53.3% (24/45) and 90.4% (38/42), respectively. Among the MRI findings, ductal enhancement, segmental enhancement and masslike enhancement had a positive predictive value of 77.8%, 71.4% and 54.5%, respectively.
Conclusion: BI-RADS categories of MRI were useful in estimating the residual lesions after lumpectomy. Ductal enhancement, segmental enhancement and masslike enhancement were most predictive of malignancy.

B-0220 15:21

Image-guided breast lesion excision biopsy versus vacuum-assisted breast biopsy for suspicious non-palpable breast lesions

N.M. Abdel Razek, M. Shaalan, O. Yousef, O.S. Omar, S. Naguib, O. Soliman; *Giza/EG (naglaabdelrazek@yahoo.com)*

Purpose: To compare the diagnostic efficiency of BLES to VAB in diagnosis of small non-palpable suspicious breast lesions.
Methods and Materials: This is a prospective study included 380 patients with small suspicious non-palpable breast lesions (BIRADS 4 & BIRADS3 with positive family history).190/380 were performed using the BLES &190/380 were performed using the VAB.The histopathology results were analysed and compared to the results of open surgery in the malignant cases.
Results: Group 1 included 190 suspicious lesions were removed using the BLES ,20%(55/190)were diagnosed after histopathology as benign including fibrocystic disease,sclerosing adenosis ,radial scars and papillomas without atypia.31.6%(60/190)were diagnosed as high risk lesions including papillomas with atypia,ALH,ADH&39.4 (75/190)were diagnosed as malignant including DCIS, LCIS,IDC&ILC.All histopathologically proven malignant lesions were exposed to Re-surgery.there was no underestimation encountered by the BLES.The margin was free in 68% of cases (51/75 malignant lesions)and the margin was flushed in 32%(24/75)of malignant cases.Group 2 included another 190 suspicious lesions removed using the VAB,33.7%(64/190) were benign,30.0%(57/190)were high risk lesions & 36.3 %(69/190)were malignant lesions.All malignant lesions were exposed to re-surgery.Underestimation after VAB was encountered in 20.5% (39/190) of cases.Underestimation of DCIS diagnosed by VAB was found in (12/25)48.0%.
Conclusion: BLES & VAB are used as the primary method for histopathology diagnosis of suspicious small&borderline lesions.BLES is favored in high risk lesions & DCIS considering the relative high underestimation rate associated with VAB and not found with the BLES. Moreover, BLES offers complete lesion removal with available margin evaluation offering good results similar to that of open surgery.

14:00 - 15:30 **Room G/H**

Genitourinary

SS 207

Uterus: imaging and intervention

Moderators:
T.J. Kroencke; Berlin/DE
I. Thomassin-Naggara; Paris/FR

B-0221 14:00

MRI in cancer of the corpus uteri staging: possibilities and limitations

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Purpose: To prospectively assess the diagnostic capabilities of magnetic resonance imaging (MRI) in the detection of local extent of endometrial carcinoma (EC) and to determine the causes of errors in evaluation of depth of myometrial invasion.
Methods and Materials: 72 consecutive patients with a histologically proven EC underwent preoperative MR imaging. 1.5 Tesla unit (Symphony Maestro Class, Siemens, Erlangen, Germany) was used with a multichannel phased-array body coil. High-resolution T2-WI in three planes were obtained, followed by T1-WI after intravenous contrast administration in 30 patients. MR findings were compared with surgical staging.
Results: Total accuracy of MRI for EC staging was 84%. For deep myometrial infiltration, a sensitivity of 56%, specificity of 92%, PPV of 69% and NPV of 87% were reached. Accuracy for contrast-enhanced scans and T2 sequences showed no statistically significant difference. Accuracy of MRI for cervical involvement detection was 95%. Errors in evaluating myometrial invasion were retrospectively divided into three groups. Cases of misdiagnosis associated with methodological errors (motion artefacts, wrong slice positioning, MRI performed in early period after curettage) were combined into the first group. Other errors were associated with concomitant pathologies (adenomyosis and leiomyomas) and age-related changes of the corpus uteri. Tumour-related factors (large polyploid tumours, tumours located in the uterine cornu, some histological types of tumour) were combined into the third group.
Conclusion: MR imaging is an effective technique for preoperative evaluation of EC. A number of errors must be taken into consideration to avoid misdiagnosis.

B-0222 14:09

The preserved fundal circumferential contour sign: a new and simple sign on 2D ultrasound to differentiate septate uterus from other double uterine cavity anomalies

R.M.K.E. Fouad, S.T. Hamed, I. Faker; *Cairo/EG (rashaakamal@hotmail.com)*

Purpose: To compare between the circumferential contour sign (CCS) and the fundal contour sign (FCS) in the diagnosis of septate uterus.
Methods and Materials: This study included 96 patients. Inclusion criteria included the presence of duplicated uterine cavity on ultrasound study. The CCS was assessd in axial images taken at the level of the fundus on 2D ultrasound. Patients were classified into 2 groups. Group A showed a preserved CCS, with no external indentations. The postulated diagnosis was 'septate uterus'. Group B included patients with disrupted CCS with a figure of 8 configuration. Findings were then correlated with the FCS on T2 W MRI coronal images and laparoscopy. Accuracy measures were calculated and compared.
Results: Group A (56 cases, 58.3%) included 49 (51%) true positive septate uteri and 7 (7.3%) false positive cases. Group B (40 cases, 41.7%) included 36 (37.5%) true negative cases and 4 (4.2%) false negative cases. Ultrasound diagnosis based on the circumferential contour sign showed significant correlation with the laparoscopy diagnosis of the patients (p: 0.00). Calculated sensitivity, specificity, positive and negative predictive values and accuracy of ultrasound in reference to the CCS were 92.4%, 83.7%, 87.5%, 90% and 88.5%, respectively, as compared to 100%, 81.8%, 86.6%, 100% and 91.6% to FCS.
Conclusion: 2D ultrasound was considered inaccurate in investigating duplicated uterine cavity anomalies due to its inadequacy in viewing the uterus in the coronal plane. The CCS assessed on the axial images has upgraded the performance of 2D ultrasound to compete efficiently with MRI and 3D ultrasound.

B-0223 14:18

Accuracy of MR imaging in the diagnosis of invasive placenta

L.J. Bour, V. Place, S. Bendavid, Y. Fargeaudou, D. Sebag-Ffez, E. Vicaut, A. Dohan, P. Soyer; *Paris/FR (jlaurence.bour@gmail.com)*

Purpose: The purpose of our study was to evaluate the accuracy of MR Imaging in the diagnosis of invasive placenta.
Methods and Materials: The MR imaging examinations of 32 women with suspected invasive placenta were blindly reviewed by four independent observers. Eleven morphological MR criteria were evaluated using logistic regression analysis. Final diagnosis obtained with MR imaging and diagnosis confidence were investigated for each reader. Final diagnosis was established by intraoperative findings or histopathological analysis.
Results: Sixteen women (16/32; 50%) had invasive placenta. Sensitivity, specificity and accuracy of reviewers ranged between 76%-93%, 78%-83% and 78%-88%, respectively. Overall sensitivity, specificity and accuracy of MR imaging were respectively 80% [95%CI: 66%-93%], 84% [95%CI: 75%-94%] and 82% [CI95% 78%-88%]. Overall interobserver correlation coefficient was fair (κappa =.40). At univariate analysis, 5 morphological MR criteria were significantly associated with the diagnosis of invasive placenta (interruption of the uteroplacental interface, p <.0001; interruption of the inner layer of the uteroplacental interface on T2-weighted images, p=.0004; loss of the normal uterine pear shape, p=.0004; intraplacental dark bands on T2-weighted images, p=.0023; and placenta previa, p=.0131). At logistic regression analysis, interruption of the uteroplacental interface was the single criteria that was significantly associated with the diagnosis of invasive placenta (p=.0006; OR=11.8).
Conclusion: MR imaging has acceptable degrees of sensitivity and specificity for the diagnosis of invasive placenta, although it is associated with a fair interobserver agreement. Interruption of the uteroplacental interface is the single independent discriminating criteria for the diagnosis of invasive placenta.

B-0224 14:27

Nulliparous vs caesarean-scarred uteri: in-vivo analysis of myometrial uterine fibres with 3 T-magnetic resonance with diffusion tensor imaging (MRDTI)

F. Fiocchi, E. Petrella, S. Currà, L. Nocetti, F. Facchinetti, P. Torricelli; *Modena/IT (federica.fiocchi@gmail.com)*

Purpose: To investigate fibre architecture of in-vivo human uterus in nulliparous and caesarean-scarred (CS) women by 3 T-MRDTI with 3D tractography. Quantitative results regarding fibres number, Fractional anisotropy (FA) and Apparent Diffusion Coefficient (ADC) were compared.
Methods and Materials: In-vivo 3 T-MRDTI was performed in 56 volunteers (12 nulliparous, I group; 44 CS, II group). Main diffusion directions reflecting fibres orientation were investigated using sense-SSEPI sequence with diffusion-sensitized gradients (b=600 mm2/s) along 16 directions within 24-months after delivery. A fibre-tracking post-processing algorithm was used to

analyse quantitatively uterine structure. Fibres running through anterior isthmus, site of suture, were compared to those running through posterior wall; FA and ADC of whole uterus and of anterior isthmus were measured.
Results: 3 T-MRDTI with 3D tractography reconstruction shows fibre disarray at scar level. In group II significant reduction of longitudinal myometrial fibres of anterior isthmus was found respect to posterior wall at the same level in comparison to group I, $p < 0.0004$ (median with IQ range: -46%; -71%-29% versus -2%; -27%22%). FA and ADC of whole uterus were similar ($p > 0.1$) in group.i. and group II, respectively 0.406±0.025 versus 0.39±0.038 and 3.364±0.456 x10-3 mm2/s versus 3.332±0.309 x10-3 mm2/s. Regarding anterior isthmus region, ADC was higher in group.i. respect to group II, although not statistically significant ($p=0.1$) as well as FA ($p > 0.1$).
Conclusion: 3 T-MRDTI with fibre tracking adds in-vivo evaluation of uterine muscular structure, quantifying fibre scar disarray. Further data and follow-up will define how this up-to-date technique could impact in the clinical management of VBAC delivery.

B-0225 14:36

3 T-magnetic resonance diffusion tensor imaging (MRDTI) of caesarean scar: morphological and quantitative evaluation - what can we add to transvaginal ultrasound?

F. Fiocchi, E. Petrella, S. Currà, L. Nocetti, T. Costi, G. Ligabue, F. Facchinetti, P. Torricelli; *Modena/IT (ffiocchi@sirm.org)*

Purpose: To investigate the potential value of 3 T-MRDTI with fibre-tracking compared to Transvaginal Ultrasound (TVU) in caesarean scar (CS) evaluation in women with one or two caesarean deliveries.
Methods and Materials: 3 T-MRDTI and TVU were performed in 44 caesarean-scarred volunteers within 24 months after delivery (29 with one CS, group I, and 15 with two CS, group II). Main diffusion directions reflecting fibres orientation were investigated using a sense-SSEPI sequence with diffusion-sensitized gradients (b=600 mm2/s) along 16 directions. CS was classified liner or retracting on the basis of MR (linear if endometrial profile was conserved; retracting if myometrial reduction/endometrial dehiscence were found). A fibre-tracking post-processing algorithm was used to analyse quantitatively fibres of anterior isthmus compared to those of posterior wall.
Results: According to 3 T-MR, 21 CS were classified as linear and 23 as retracting with TVU global agreement of 54.5%. Uterine isthmocele was found in 8 women (4 each group; agreement 75%). 3 T-MRDTI fibre-tracking analysis of myometrial fibres running through CS in anterior isthmus respect to posterior wall showed no significant difference in fibre disarray between group.i. and II (-55%,IQ-32%-74% versus-42%,IQ-31%-58%,$p > 0.4$). Among uteri with retracting CS, fiber reduction was significantly higher compared to those with linear CS (-55%,IQ-37%-83% versus -40%,IQ-4%-61%, $p < 0.001$). At follow-up, 7 women of group.i. had vaginal delivery; median fibre reduction was -43%, lower respect to the median of group.i. ($p=0.1$).
Conclusion: 3 T-MRDTI with fibre-tracking approach adds quantitative data at morphological analyses of TVU, relying on evaluation of residual fiber muscle at scar level.

B-0226 14:45

Quantitative dynamic contrast-enhanced MRI in symptomatic uterine fibroids and normal uterus

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Purpose: Quantitative dynamic contrast-enhanced MRI (DCE-MRI) is an imaging technique to measure permeability and vascularity of the tissues. The aim of this study was to compare the Ktrans, Kep and Ve of normal myometrium with the fibroids.
Methods and Materials: 16 normal subjects underwent DCE-MRI study of the pelvis. After routine pelvis MRI protocol DCE-MRI was done using T1 volumetric (LAVA) sequence. The data were post-processed by DCE-MRI software and parameters [K-trans: volume transfer between the blood plasma and extracellular fluid, Kep: Rate constant between the EES and blood plasma, Ve: EES fractional volume] were determined for the myometrium, endometrium and cervix. 16 patients with clinical diagnosis of uterine fibroids were examined using the same DCE-MRI protocol. Hysterectomy was performed after MRI and uterine fibroids were confirmed by histopathology results. The Ktrans, Kep and Ve of normal myometrium and fibroids were compared.
Results: The mean ktrans in myometrium and endometrium were 0.45 min-1, 0.40 min-1 in cervix and 0.80 min-1 in fibroids. There is significant difference (P value < 0.05) between the K-trans of fibroid tissue and normal myometrium. There was no significant difference between k-trans, Kep and Ve of myometrium, endometrium and cervix.
Conclusion: The significant difference (P value < 0.05) between the K-trans of fibroid tissue and normal myometrium indicates that the permeability of fibroid tissue is higher than normal myometrium. It also supports the role of DCE-MRI in functional assessment of tumour microcirculation. These findings may provide the foundation for interpretation of results of uterine DCE-MRI studies.

B-0227 14:54

Magnetic resonance-guided focused ultrasound (MRgFUS) in women affected by uterine fibroids: outcomes on symptoms, quality of life, non-perfused volume ratio and size reduction over 12 months

F. Ciolina, F. Zaccagna, F. Boni, B. Cavallo Marincola, F. Sandolo, L. Bertaccini, A. Napoli, C. Catalano; *Rome/IT (federica.ciolina@gmail.com)*

Purpose: To investigate the efficacy of MR-guided acoustic ablation in symptoms relief and volume reduction over time.
Methods and Materials: 120 fibroids in 95 symptomatic women (average age 40.8) were ablated using MRgFUS. Treatment is done using the ablative properties of the HIFU system under 3 T MRI guide. Symptoms and quality of life were scored using Severity Score (SS) and the Uterine Fibroids Score Quality of Life Score (UFS-QOL). Pre-treatment measurements of leiomyoma volume were obtained on pre-treatment MR images and immediately after treatment non-perfused Volume (NPV) was calculated from T1-w contrast-enhanced MR sequences. The average volume of treated fibroids was 84.76 ± 84.78 mm3. Follow-up images were obtained 3, 6 and 12 months after treatment and served to determine leiomyoma shrinkage. Qualitative and quantitative relations between fibroid volume, NPV ratio at treatment, 3, 6 and 12-months shrinkage were measured.
Results: MRgFUS treated patients results in a significant change in USF-QoL score: mean SS score values were 48.6 ± 13.4 (pre-treatment), 25.1 ± 8.9 (three-months follow-up), 22.1± 7.5 (six-months follow-up) and 19.3± 6.8 (twelve-months follow-up). Fibroids volume changed from 84.76 ± 84.78 mm3 (before treatment) to 54 ± 66.1 mm3 (at 12 months follow-up). We encountered a statistically significant difference between the two values ($p = 0.001$). Mean post-treatment VNP was 59.90±56.47 mm3 ($p=0.001$).
Conclusion: Patients treated using MRgFUS therapy showed a significant relief of symptoms and significant fibroid ablation. The procedure is performed in a totally non-invasive manner and with a high safety profile.

B-0228 15:03

Retrospective evaluation of uterine fibroids treated using MRgFUS: elements that can predict short and long-term results

F. Ciolina, F. Boni, F. Zaccagna, V. Noce, L. Bertaccini, B. Cavallo Marincola, A. Napoli, C. Catalano; *Rome/IT (federica.ciolina@gmail.com)*

Purpose: To retrospectively analyse predictive elements to obtain an optimal treatment of uterine fibroids in patients treated using magnetic resonance-guided focused ultrasound (MRgFUS).
Methods and Materials: 75 fibroids (52±18 mm) in 68 symptomatic women (age average 41±5) were treated using MRgFUS (ExAblate 2100) combined with a 3 T MR unit (GE). T2 SI of fibroids and T1 SI were measured on pre-treatment examination before and after administration of gadolinium (Gd-BOPTA, Bracco); also the distance between center of myoma and skin, skin thickness, maximum diameter and volume of fibroids were recorded. The day of treatment the non-perfused volume (NPV) was recorded at the end of the treatment. All parameters were related to final NPV and volume shrinkage at 12 months to established short and long term outcomes of treatment.
Results: Difference between T1 SI of the fibroids and healthy myometrium significantly correlates with volume shrinkage (45%) and NPV (60%, r=0.85). T2 SI on pre-treatment studies, distance between skin surface and center of myoma (53±19 mm) and skin thickness (13±7 mm) show a mild correlation with volume reduction at 12 months (36+18 mm, respectively r=-72.5 p=0.047 and r=69.7 p=0.03). Each sonication was of 20±2 s (2540±1095 J/sonication) and mean average duration of treatment was of 125±30 min. Moreover, there was positive correlation between measured parameters, sonication duration and energy necessary to obtain a > 50% NPV (70±15%, r= 62.8, p=0.021).
Conclusion: SI ratio on T1w of uterine fibroids and myometrium on screening MRI should be considered as predictor of positive outcome for MRgFUS.

B-0229 15:12

Value of parametric maps in the assessement of uterine lesions by combination of DWI and semi-quantitative perfusion dynamic contrast-enhanced (DCE) MRI

A.C. Cadonici, D. Ippolito, O. Minutolo, P. Bonaffini, C. R.G.L. Talei Franzesi, S. Sironi; *Monza/IT (a.cadonici@gmail.com)*

Purpose: To investigate the value of combined diffusion-weighted imaging and DCE-MRI in the assessement of benign and malignant uterine lesions.
Methods and Materials: We enrolled 50 patients with endometrial cancer who underwent pre-operative MR examination on 1.5 T magnet: scanning protocol included multiplanar T1- and T2-weighted TSE,10 dynamic gadolinium-enhanced T1-weighted GE sequences (overall time 5 min, 66 sec) and DWI sequences (*b* value: 0.1000 mm^2/s). ADC and perfusion maps were generated on dedicated workstation and regions of interest (ROIs) were manually drawn on each identified uterine lesion and on normal myometrium. Mean ADC, relative enhancement (RE, %), maximum enhancement (ME, %), maximum

relative enhancement (MRE, %) and time-to-peak (TTP, sec) were calculated and statistically analysed.
Results: Post-operative histological examination confirmed the presence of endometrial cancer in all the patients and the presence of 23 miomas. The following parameters were obtained for neoplastic tissue: ADC 916.05 mm²/sec± 313.8 x10-3; RE 72.25% ± 33.9; ME 976.8% ± 331.7; MRE 90.9% ± 24.1; TTP 192.1sec ± 100.6, in miomas: ADC 1025.5 mm²/sec ± 436.1; RE 95.1% ± 48.6; ME 1357.3% ± 798.7;MRE 107.4% ± 47; TTP 233.8 sec ± 126.3 and in normal myometrium: ADC 1548.9 mm²/sec ± 277.6; RE 163.3% ± 34.2; ME 2010.1% ± 291.7; MRE 170.7% ± 31.2; TTP 242.8 sec ± 121.5. Mean ADC, RE, ME and MRE were significantly lower ($p > 0.05$) both in neoplasms and in miomas than in normal miometrium, no significant difference was found between miomas and neoplastic lesions.
Conclusion: Combined DWI and DCE-MRI offer in vivo information that can be useful in depiction and characterisation of uterine lesions.

B-0230 15:21

Diagnostic value of ontrast-enhanced perfusion MR imaging in the assessment of tumour grading in patients with endometrial carcinoma by using quantitative analysis of microvascular changes: preliminary results
O. Minutolo, D. Ippolito, A. Cadonici, C. R.G.L. Talei Franzesi, P.A. Bonaffini, S. Sironi; *Monza/IT (orazio.minutolo@hotmail.it)*

Purpose: To determine diagnostic value of dynamic contrast-enhanced perfusion-MRI in detection and characterisation of endometrial cancer,correlated with tumor grading,being the histopathological analysis the standard of reference.
Methods and Materials: From January 2011 to July 2012.80 patients with histologically proven endometrial carcinoma underwent dedicated pelvic MRI examination by using pelvic phased array multicoil.Each patient scan consists of multiplanar T2 and T1 sequences and dynamic contrast enhanced THRIVE,using a 1.5 T MRI system (Achieva,Philips).Philips's workstation was used to generate color permeability maps showing perfusion of enhancing tumors.After the placing of regions of interests (ROIs)on the site of maps which best corresponded to enhanced regions of lesion,the following parameters were calculated:Relative Enhancement,Maximum Enhancement,Maximum Relative Enhancement and Time to Peak.
Results: Pathological results of all patients were obtained postoperatively and compared with DCE-MRI perfusion parameters.At histological examination 21 patients had G1 tumor,44 had G2 tumor,14 had G3 tumor,and 1 had squamous cell carcinoma.Tumor locations visualised on T2w MRI and DSCE-MRI were consistent with histopathological findings and the quantitative analysis showed the following values for endometrial cancer:RE (%)61.4±36.4;ME (%)829.4±418.8;MRE (%)69.4±42.2 and TTP (sec)179.5±27.4.Corresponding values calculated in normal endometrium were:RE (%)157.1±61.3;ME (%)1634.5±625.7;MRE (%)128.8±51.6 and TTP (sec)193.6±23.8.A significant ($p < 0.001$)decrease of RE,ME and MRE in the area of tumor lesion in all of the patients examinated in comparison with the normal myometrium was observed.Furthermore a significant higher values ($p < 0.001$)of RE,ME,MRE was obtained for G1 tumours (less aggressive)in comparison with those with G2 or G3 grading.
Conclusion: Conventional MRI combined with perfusion DCE represents a feasible technique that provide non-invasively quantitative and qualitative information about biological characteristics of endometrial cancer,related to tumor aggressiveness.

14:00 - 15:30 **Room I/K**

Neuro

SS 211
Stroke imaging

Moderators:
A.K. Firat; Malatya/TR
M.M. Thurnher; Vienna/AT

B-0231 14:00

Swirl sign is a robust predictor of spot sign on CTA and poor outcome in ultra-early ICH patients
C. Ovesen, I. Havsteen, A. Christensen, C. Krarup, H. Christensen; *Copenhagen/DK (seestein@gmail.com)*

Purpose: Computed tomography angiography (CTA) spot sign signifies active bleeding and poor outcome in intracerebral haematoma (ICH) patients. CTA is not as available as non-contrast CT (NCCT). NCCT swirl sign is a less well-described marker of active bleeding. We investigate if swirl sign predicts spot sign and poor outcome in ultra-early ICH patients?
Methods and Materials: We included spontaneous ICH patients admitted within 4.5 hours from symptom onset April 2009-January 2013. Standard workup included NCCT and CTA. Swirl sign was defined as hypo- or isodense regions within the hyperdense haematoma with brain parenchyma as reference. Outcome was assessed as 90-day modified Rankin Scale (mRS).
Results: 35 of 137 patients (25.5%) showed swirl sign and 27 (77%) had concomitant spot sign. This yields a high specificity (0.92) and negative predictive value (0.86) but slightly lower sensitivity (0.66) and positive predictive value (0.77). Swirl sign independently predicted presence of spot sign (OR 15.5 CI: 5.6-42.8) adjusted for admission haematoma volume and time to scan. Swirl sign was associated with poorer median [IQR] 90-day mRS (5 [4-6] vs. 3 [2-5], $p < 0.0001$). Swirl sign emerged as independent predictor of poor outcome (mRS 5-6) (OR 3.28 CI: 1.15-9.34) adjusted for age, admission NIHSS, and admission haematoma volume. Concurrent spot and swirl sign did not add to the prediction of poor outcome.
Conclusion: Swirl sign predicts spot sign presence and entails poor outcome irrespective of other predictors. Further studies are needed to evaluate the swirl sign's value in clinical decision-making and trials.

B-0232 14:09

Intramural haematoma detection by susceptibility weighted image in intracranial vertebral artery dissection
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Purpose: We aimed to evaluate accuracy of intramural haematoma sign on susceptibility weighted image (SWI) in vertebral artery dissection (VAD).
Methods and Materials: We retrospectively analysed patients with ischaemic stroke in the vertebral artery territory from 2010 to 2012. We divided the patients into VAD group and non-dissection group. Intramural haematoma sign was considered positive if the patient had (a) eccentric or concentric hypointense signal lesion in vertebral artery on SWI and (b) this signal should be hyperintense on phase map and no evidence of calcification on the brain CT suggesting blood products other than calcification. The accuracy of intramural haematoma sign on SWI was evaluated. Phase value, demographic and clinical data were compared between VAD and non-dissection group.
Results: Thirty-nine patients were included. Ten patients were VAD group and 29 patients were non-dissection group. Among 10 cases of VAD group, the "Intramural haematoma sign on SWI" was positive in 9, and positive in 1 out of 29 cases in the non-dissection group. The intramural haematoma sign on SWI was significantly associated with VAD ($p < 0.001$) and showed sensitivity of 90%, specificity of 96.6%. Mean phase values of intramural haematomas (n=9) were all positive and those of calcified lesions (n=13) were all negative (0.45±0.17 radian vs. -0.42±0.28 radian, $p < 0.001$).
Conclusion: The intramural haematoma sign on SWI was significantly associated with VAD and the phase values were higher in intramural haematomas compared with atherosclerotic calcifications.

B-0233 14:18

High-resolution MR imaging in patients with symptomatic middle cerebral artery dissection
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Purpose: To investigate the findings of high-resolution magnetic resonance imaging (HRMRI) and clinical features in patients with acute symptomatic middle cerebral artery (MCA) dissection.
Methods and Materials: Ten patients with acute symptomatic MCA dissection underwent HRMRI within 3 days after initial clinical onset and routine brain MR imaging. HRMRI examinations include time-of-flight (TOF) MR angiography, T2-weighted, T1-weighted, proton-density (PD)-weighted, and three-dimensional magnetization-prepared rapid acquisition gradient-echo (MPRAGE) sequences. MR angiography and/or cerebral angiography were used as the reference standard to establish the diagnosis of MCA dissection. We analysed the angiographic findings and HRMRI findings such as string sing, peal and string sign, intimal flap, double lumen, and intramural hematoma.
Results: All patients presented with cerebral ischaemia (median NIHSS score = 2, range = 0 - 18). Nine patients excluded one with traumatic event, did not have any history of trauma. The main site of the lesions was Lt M1 portion. On TOF MR angiography and/or cerebral angiography, string sign was seen in five patients. However, intimal flap and double lumen findings were seen in all patients on HRMRI. High signal lesion on MPRAGE sequences around the dissection lumen due to intramural haematoma, was seen in three patients.
Conclusion: HRMRI can be able to easily detect the wall structure of MCA such as the intimal flap and double lumen in patients with acute symptomatic MCA dissection. MPRAGE can detect haemorrhage in the false lumen of MCA dissection.

B-0234 14:27

Clinical significance of intraluminal contrast enhancement in patients with spontaneous cervical artery dissection: an in vivo MRI study

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Purpose: Recent studies have suggested that intraluminal thrombi show strong contrast enhancement on carotid black-blood MRI. The aim was to evaluate the significance of intraluminal contrast enhancement (iCE) on symptom status in patients with spontaneous cervical artery dissection (sCAD).
Methods and Materials: 33 consecutive patients (19 men) with sCAD received a brain MRI (DIFF, T2w, T2*w, FLAIR, TOF) and a multi-sequence 3 T-MRI with fat-saturated high-resolution black-blood T1w-sequences pre- and post-contrast, MRA, T2w- and TOF images of both carotid and vertebral arteries. Presence or absence of iCE, vessel occlusion and vessel wall haematoma (VWH) were analysed by two radiologists in consensus decision who were blinded to all clinical information and the brain MRI.
Results: 44 of 132 analysed vessels had a VWH, consistent with sCAD. In 17 of 44 dissected vessels an acute ischaemic stroke was found in the territory of the corresponding vessel. 16 of 17 (94.1%) vessels ipsilateral to ischaemic stroke demonstrated iCE, compared to 9 of 44 (20.4%) dissected vessels without stroke in the corresponding vessel territory (Fisher´s Exact test $P < 0.001$). The presence/absence of iCE for ischaemic stroke in dissected vessels resulted in a sensitivity, specificity, positive and negative predictive value and accuracy of 0.94, 0.67, 0.64, 0.95, and 0.77 and an odds ratio of 32.0 (95% confidence interval = 3.64 - 281).
Conclusion: iCE, suggestive of intraluminal thrombus formation, is strongly correlated with ischemic symptoms in patients with sCAD. Future studies will have to determine whether patients with iCE are at greater risk of recurrent stroke.

B-0235 14:36

CT-verified leukoaraiosis as risk factor for post-thrombolytic symptomatic haemorrhage

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Purpose: Is CT-verified leukoaraiosis a risk factor for symptomatic post-thrombolystic haemorrhage?
Methods and Materials: 1) Retrospective analysis of single-centre consecutive TPA-treated patients within 4.5 hours from symptom onset. Standard work-up included baseline non-contrast CT (NCCT) and CT angiography and next day follow-up NCCT. Baseline NCCT leukoaraiosis was graded using Fazekas' score and dichotomised as absence (Fazekas 0) or presence (Fazekas 1-3). Haemorrhagic transformation was rated using ECASS criteria. Symptomatic intracerebral haemorrhage (sICH) was defined as haemorrhage and deterioration oh NIHSS≥4 within 36 hours from symptom onset. EVT-treated patients were excluded. 2) Pooled analysis with 1312 TPA-treated patients from literature.
Results: 311 TPA-treated were included April 2009 - July 2012. Leukoaraiosis was present in 113 (36%). 23 (7%) showed haemorrhagic transformation (HT). Leukoaraiosis positive patients had significantly higher haemorrhagic transformation frequency (11.5%, p=0.04). Leukoaraiosis doubled HT risk (OR 2.4, 95% CI 1.4-5.8). Only 4 patients developed sICH, 3 with leukoaraiosis. Leukoaraiosis was not an independent risk factor for haemorrhagic transformation (p=0.2). Pooled analysis of 1623 patients in total, hereof 479 leukoaraiosis positive patients, showed significantly higher sICH frequency in 35 (7.3%) leukoaraiosis positive than 44 (3.8%) leukoaraiosis negative patients, (p=0.005) and doubled sICH risk in leukoaraiosis positives (OR 1.97, 95% CI 1.22-3.19).
Conclusion: Leukoaraiosis is a risk factor for post-thrombolytic haemorrhagic transformation and symptomatic haemorrhage.

B-0236 14:45

Analysis of association between carotid artery plaque volume and cerebral microbleeds

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Purpose: Cerebral microbleeds (CMBs), have become increasingly recognised with the widespread use of MRI techniques that are sensitive to iron deposits. Our purpose was to explore the association between carotid plaque volume and CMBs.
Methods and Materials: 82 consecutive (males 59; median age 64) patients were prospectively analysed. Carotid arteries were studied using a 16-detector row CT scanner whereas brain was explored with a 1.5 Tesla system. CMBs were studied using a T2*-weighted gradient-recalled echo (GRE) sequence. Microbleeds were classified as absent (grade 1), mild (grade 2; total number of microbleeds, 1-2), moderate (grade 3;total number of micro-bleeds,3-10), and severe (grade 4;total number of microbleeds,> 10). Component types of the carotid plaque were defined according HU values. Plaque volumes of each component was calculated. Chi-square, multiple logistic regression analysis as well as ROC was calculated.
Results: The prevalence of CMBs was 35.3%. A statistically significant difference was observed between symptomatic (40%) and asymptomatic (11%) patients (p value = 0.001; OR = 6.07). Linear regression analysis demonstrated an association between the number of CMB and the symptoms (p = 0.0018). A statistically significant correlation was observed between the increase of the volume of the fatty component and CMBs (rho = 0.89; p = 0.001).
Conclusion: Results of this study confirm the association between CMBs and symptoms and that there is an increased number of CMBs in symptomatic patients. Moreover, we found that an increased volume of the fatty component is associated the presence and number of CMBs.

B-0237 14:54

Symmetrical plaque progression rates in bilateral carotid atherosclerosis: the impact of local plaque factors

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Purpose: The purpose of this study was to evaluate the symmetry of progression or regression of bilateral carotid atherosclerosis during a seven month follow-up period.
Methods and Materials: As the placebo arm of a multi-center clinical trial, 54 subjects with 16-79% carotid stenosis by ultrasound and presence of a lipid core on baseline MRI underwent follow-up carotid MRI at seven months. Wall, lipid core, and plaque components such as intraplaque hemorrhage (IPH) and ulcer were assessed on both sides on the baseline and follow-up scans. Progression between bilateral carotid plaques was calculated as changes within the common coverage between scans.
Results: Forty-three (79.6%) of the subjects were on lipid-lowering therapy. Bilateral wall volume progression or regression was found in 31 subjects (57.4%) and unilateral IPH was present in six (11.1%) subjects at baseline. In the sample as a whole, there was little correlation in wall volume progression between sides (r=-0.02, p=0.883). However, progression was significantly correlated between sides in the group without IPH (r=0.31, p=0.034) and was significantly different (p=0.011) than in the group with unilateral IPH (r=-0.60, p=0.208). In those with IPH, mean progression was 29.9 ± 55.7 mm^3 on the side with IPH and -26.9 ± 29.3 mm^3 on the non-IPH side (p=0.131).
Conclusion: In the absence of intraplaque hemorrhage, carotid atherosclerotic lesion volume tends to change in the same direction bilaterally, potentially due to systemic processes.

B-0238 15:03

Diagnostic accuracy of whole-brain CT perfusion imaging in small-volume infarctions

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Purpose: The aim of this study was to determine the diagnostic accuracy of whole brain CT perfusion (WB-CTP) in small ischemic brain infarctions and to identify factors influencing the detection rate.
Methods and Materials: Out of a cohort of 1380 subjects who underwent initial WB-CTP due to suspected stroke, we selected all patients with a supratentorial MRI-confirmed ischemic infarction with a volume of ≤ 8 ml. The study was designed as a case-control study with a ratio of cases to controls with no infarction in follow-up MRI of 1:3. Two blinded readers independently evaluated four different CT perfusion parameter datasets per subject with respect to presence and localisation of a perfusion deficit.
Results: A total of 113 subjects met the inclusion criteria for the patient group. Overall, WB-CTP reached a sensitivity of 43.4% and a specificity of 92.9%. Among these, cortical infarctions were detected in 31 of 49 cases (69%), while subcortical infarctions were detected only in 18 of 64 cases (28%), $p < 0.05$. Mean final infarction diameter (17.3 mm) and volume (1.9 ml) of infarctions detected on CTP were significantly larger than that of infarctions not detected (12.4 mm and 0.8 ml, respectively; $p < 0.001$). Time from symptom onset did not differ significantly between infarctions that were detected or not (204 vs. 189 min; p=0.75).
Conclusion: The detection rate of WB-CTP in small infarctions highly depends on infarction localisation and final size, while time from symptom onset does not seem to influence diagnostic accuracy.

B-0239 15:12

Dynamic CT angiogram in acute stroke: a complementary look at perfusion

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Purpose: CT angiogram and CT perfusion have been established as an important tool for evaluation of the acute stroke patients. With the advent of 320 slice whole brain CT scanner, we are able to generate whole brain perfusion and time resolved dynamic CT angiogram (dCTA) images that provide temporal flow information.
Methods and Materials: Retrospective assessment of 53 consecutive patients presenting with acute stroke was performed. The dynamic CT angiogram 3D MIP data are interpreted with documentation of the time of arrival of contrast at the supraclinoid ICA, M1, M2 and distal cortical branches at equivalent position on each side. The filling of cortical branches is also analysed for antegrade or retrograde flow.
Results: Correlation between the final volume infarct on follow-up CT scan with the delay in appearance of contrast between sides at different vascular levels was calculated using Pearson correlation coefficient. This was significant at the cortical level ($r = 0.7$ $p < 0.0001$). Retrograde flow in cortical branches was noted in 8 subjects. Most important observation in this study was the exclusion of any significant infarct in presence of a symmetric dynamic CTA. The smallest infarct size in presence of a delay in filling was 10.2 ml. In patients with smaller infarcts, the dynamic CTA was symmetric.
Conclusion: dCTA is complementary to perfusion maps and enables us direct visualisation of intracranial flow. Symmetric dynamic CTA is an excellent predictor of very small or no infarct.

B-0240 15:21

20 minutes' door-to-needle time in acute ischaemic stroke is achievable in a radiology-neurology team structure

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Purpose: We aimed at reducing our median door-to-needle-time (DTN) to below 20 minutes by improving the organisational structure of our acute stroke evaluation while accepting no increase in bleeding complications.
Methods and Materials: A team including radiologist, neurologist, stroke nurse and radiographer set up a structured patient admission process based on trauma team principles and experience with fibrinolysis. The team in a dedicated room within radiology department receives the patients with immediate access to both CT and MRI; standard work up is CT plus CTA. During a 3-month registration period in 2013 an external person registered all cases of acute stroke evaluation. For comparison, data from 2012 was used.
Results: A total of 148 patients was registered and was characterised by a median age of 67 years and 53.4% males. Forty-seven patients (31.8%) received fibrinolysis. The overall median DTN was 16 minutes 58 seconds. For patients receiving fibrinolysis, the DNT was 20 minutes 58 seconds and for patients not receiving treatment the median time to decision was 15 minutes, 50 seconds. No symptomatic intracranial haemorrhages or other significant bleeding complications occurred during the study period. Median DTN in 2012 was 49 minutes; and costs were neutral.
Conclusion: DTN-time can safely be reduced to 20 minutes by organisational interventions, in particular changing the auspice from neurological to radiological. NNT is reduced by 1 with every 20 minutes reduction in DTN; thereby this intervention has a clinically significant impact on stroke outcome.
Author Disclosures:
S. Henriksen: None. **L. Jeppesen:** None. **A. Christensen:** None. **H. Christensen:** None.

14:00 - 15:30 **Room L/M**

Physics in Radiology

SS 213

Optimising image quality and patient exposure in CT

Moderators:
P.E. Colombo; Milan/IT
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B-0241 14:00

Reconstruction of organ doses in paediatric CT performed in the 90-thies in Norway

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Purpose: A large epidemiological study (EPI-CT) aims to provide knowledge about the risk of leukemia and brain cancer associated with pediatric CT, http://epi-CT.iarc.fr/. New computational human phantoms and software have been developed to provide estimates of the organ doses. The aim was to reconstruct organ doses from CT examinations done in the 1990s with the new software; to sort out the probable range of doses as input to uncertainty estimates in EPI-CT.
Methods and Materials: We used local typical scan protocols in Norway from CT scanners used in the 1990s, and a beta version of the new software provided for EPI-CT.
Results: A one year old child could have received 54 (17-77) mGy to the brain, and 21 (7-31) mGy to active marrow from a head CT scan. From CT of the chest, a newborn could have received 14 (10-21) mGy to active marrow. From an abdominal CT scan, 10 year old children could have received doses of 10 (6-17) mGy to active marrow. These doses are considerably higher than the age-adjusted protocols nowadays.
Conclusion: The doses children received from CT during the 1990s are of such a magnitude that they might show statistically significant health effects in the EPI-CT project. In Pre-PACS time there may be lack of knowledge about the size of the child, the CT scanner model used, or the scan parameters used. All these parameters result in differences in organ doses by a factor of 2 - 3.
Author Disclosures:
I. Thierry-Chef: Research/Grant Support; EU (FP7/2007-2013) under grant agreement number 269912 - EPI-CT.

B-0242 14:09

Dose reduction with dual-energy body CT: feasibility of concurrent spectral analysis and dose modulation

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Purpose: Dose modulation (DOM) reduces patient dose by minimising x-ray tube current according to patient size. The effectiveness of DOM is limited in dual-energy CT (DECT) systems based on two tubes producing different energies or energy-switching in one tube. Spectral-detector CT (SDCT) technology uses only one x-ray beam separated into two energies by innovative dual-layer detectors and should enable effective DOM. The purpose of this study was to evaluate the feasibility of dose reduction in an SDCT prototype.
Methods and Materials: Following IRB approval and informed consent, 37 patients (mean age 56.6 years) were scanned with a novel-SDCT prototype (Philips Healthcare, Cleveland, OH, USA). Eleven patients were scanned with an abdomen/pelvis protocol, 14 with chest/abdomen/pelvis protocol, and 12 with a chest protocol. Scanning parameters were 120 kVp, mAs ranging from 59 to 259. Dose length product (DLP) and CT dose-index ($CTDI_{VOL}$) were analysed for each patient to estimate dose savings (EDS).
Results: The estimated dose savings (ESD) was highest in chest scans (22.4%), resulting in the lowest DLP and $CTDI_{VOL}$ values (363.6 mGy·cm ,11.36 mGy, respectively). In chest/abdomen/pelvis scans dose saving was lower (21.4%), resulting in 786.1 mGy·cm and 13.2 mGy, respectively, and in abdomen/pelvis scans it was lowest (14.8%), resulting in 807.0 mGy·cm and 14.9 mGy, respectively. Dose saving was significantly higher for chest scans and chest/abdomen/pelvis scans compared to abdomen/pelvis scans ($p < 0.05$ and $p < 0.04$, respectively).
Conclusion: SDCT can concurrently reduce patient dose substantially by effective tube current modulation and enable full benefits of spectral analysis.
Author Disclosures:
Z. Romman: Employee; Philips. **J. Sosna:** Grant Recipient; Philips.

B-0243 14:18

Should automatic exposure control be used in CT imaging of pregnant patients?

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Purpose: To assess the effect of maternal body size at different stages of gestation on maternal effective dose and embryo dose in routine abdomen and pelvis CT imaging of pregnant patients using automatic exposure control (AEC).
Methods and Materials: The adult anthropomorphic Rando phantom was used to simulate an average pregnant individual at the 1st trimester of gestation. The abdominal slices of the phantom were appropriately devised using Lucite material to simulate pregnancy at the 2nd and 3rd trimester. Each phantom was scanned with fixed mA and with the AEC-activated, using a 16-row CT scanner. Thermoluminescent dosimeters were used to determine absorbed dose at all maternal radiosensitive organs and embryo. Maternal effective dose was calculated based on the ICRP 103.
Results: Maternal effective dose and embryo dose in fixed mA acquisitions were 7.1 mSv and 18.6 mGy at the 1st, 7.3 mSv and 17.7 mGy at the 2nd, and 7.5 mSv and 15.4 mGy at the 3rd trimester of gestation. The corresponding values in AEC-activated acquisitions were 3.6 mSv and 7.5 mGy, and 3.9 mSv and 8.8 mGy, and 4.2 mSv and 7.9 mGy, respectively.
Conclusion: AEC efficiency is not hampered by the increased abdominal size of pregnant individuals. The AEC may substantially reduce maternal effective dose and embryo dose even at the 3rd stage of gestation when abdomen has reached its maximum size. AEC should thus be activated without caution in pregnant patients referred to abdomen and pelvis CT imaging.

B-0244 14:27

Size-specific dose estimates (SSDE) for the evaluation of individual patient dose in CT protocol for renal colic

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Purpose: To evaluate the effects of an institutional unenhanced CT protocol for renal colic on image quality and radiation dose reduction using size-specific dose estimates (SSDE).
Methods and Materials: 52 consecutive patients with acute renal colic underwent CT with reduced radiation dose (120 kVp; NI, 59.1; pitch, 0.984:1). The evaluated radiation dose descriptors were SSDE (mGy), CTDI (mGy). Signal-to-noise ratio (SNR), contrast-to-noise atio (CNR). Subjective image assessment by two radiologists were performed. Visibility of abdominal, pelvic parts of ureters, ureterovesical junctions and overall subjective image quality were evaluated. The control group comprised 52 consecutive patients who underwent routine CT on the same scanner.
Results: SNR of aorta, spleen, fat and psoas muscle were significantly smaller in the renal colic group than the control (1.1 vs. 2.0; 1.8 vs. 3.0; 5.1 vs. 7.5; 2.0 vs. 3.1; respectively; $p < 0.001$). However, no statistically significant differences in SNR of bladder and liver, and CNR of liver-spleen, liver-fat, aorta-muscle and muscle-fat pairs were noted. Subjective image quality was better in the control group (2.8 out of 3 possible points vs. 2.4). Differences in the visibility of all 3 parts of ureters were not statistically significant (2.8 vs. 2.9; 2.2 vs. 2.4; 2.4 vs. 2.7). Significant radiation dose reduction in the renal colic group was achieved (SSDE, 8±4 mGy vs. 22±8 mGy; CTDI, 7.5±4.8 mGy vs. 19.1±10.2 mGy, $p < 0.001$).
Conclusion: The institutional renal colic CT protocol provides a clinically good image quality. Ureters' visibility and SNR/CNR values show that this protocol should replace standard CT protocol.

B-0245 14:36

High correlation between CT radiation dose estimates obtained by fast monte carlo computation and solid-state metal-oxide semiconductor field-effect transistor measurements in physical anthropomorphic phantoms

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Purpose: Accurate, patient-specific estimation of radiation dosimetry for CT protocols is critical to optimise radiation doses and balance dose against image quality. While MC simulation is often used to estimate doses from CT, few data compare such estimates against experimentally measured doses in contemporary CT scanners. We aimed to compare radiation dose estimates from a MC approach to doses measured using MOSFETs in a 256-slice volume scanner.
Methods and Materials: 50 MOSFETs were placed inside a modified ATOM (CIRS, Norfolk, VA) tissue-equivalent anthropomorphic phantom. The phantom was then scanned using an iCT scanner (Philips, Cleveland, OH) with a chest protocol (helical scan, 120 kVp, 360 mAs). MC computations were performed on voxelised CT images of the phantom with a MC tool developed specifically for diagnostic X-ray energies (DiPhoS, Philips Research, Eindhoven, The Netherlands).
Results: In the directly irradiated section of the phantom the ratio of the MOSFET measurements and the MC computations was 0.99±0.06 (30 data points) and 0.97±0.03 (26 data points) for the female and male version of the phantom, respectively. For comparison, the error bar on the individual ratios, mainly composed of measurement uncertainties, was 0.06. In the region receiving only scattered radiation dose ratios were also consistent with a value of 1.
Conclusion: Radiation dose estimation using a MC method is strongly correlated with experimental measurements. The availability of dose distribution estimates based on actual reconstructed patient CT images may offer the potential for accurate patient-specific CT dosimetry.
Author Disclosures:
S. Trattner: Research/Grant Support; Philips Healthcare. **C.M. Thompson:** Research/Grant Support; Philips Healthcare. **S. Halliburton:** Research/Grant Support; Philips Healthcare. Speaker; Philips Healthcare. **A.J. Einstein:** Research/Grant Support; Philips Healthcare, GE Healthcare.

B-0246 14:45

Use of CT dose notification and alert values in routine clinical practice

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Purpose: The purpose of this investigation was to assess the impact on workflow of the use of notification and alert values in our practice and to provide baseline data for quality improvement initiatives.
Methods and Materials: Five diagnostic, clinical CT scanners were programmed with the notification and alert values recommended by the American Association of Physics in Medicine. Retrospective analysis was performed on log files to assess the frequency of and reason for notification and alert events.
Results: Between February and September of 2012, 11,384 patients were scanned on the five systems. One alert occurred due to the use of bolus tracking in a morbidly obese patient, where the pre-scan cumulative $CTDI_{vol}$ for the exam exceeded the recommended alert value of 1000 mGy. Only 1.2 ± 0.6% of patient scans triggered a notification. Notifications were mainly triggered due to bolus tracking and/or large patient size. Protocols triggering notifications most often included CT angiography of the chest for pulmonary emboli.
Conclusion: Because only a small percentage of performed patient examinations triggered a notification or alert event, the impact on workflow of adopting these features was negligible. Evaluation of the logs identified trends in reasons for which notification events were triggered; these primarily included large patient size and bolus tracking. Additionally, specific protocols were identified where adjustment of notification values was deemed necessary.
Author Disclosures:
C.H. McCollough: Grant Recipient; research support from Siemens Healthcare, outside the submitted work.

B-0247 14:54

The assessment of effective dose and organ dose taking tube current modulation into account

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Purpose: To evaluate the effect of including longitudinal tube current modulation (TCM) versus using the average mAs on organ dose and effective dose (E) calculations.
Methods and Materials: 97 consecutive adult patients (46 female, 51 male) underwent thorax/abdomen scans performed with TCM (CareDose 4D, Siemens Definition Flash) at 120 kVp, 110 (thorax) and 200 (abdomen) reference mAs. Body mass index (BMI) of all patients was registered. Doses to fully irradiated organs (breasts, lungs, stomach, liver and ovaries) and E were calculated using two versions of CT-Expo: v.2.0, which uses the patient average mAs and the new version 2.2, which includes an approximation of the longitudinal modulation. Student t-test was used to asses statistical significance.
Results: We found a significant difference ($p < 0.001$) for E, on both thorax and abdomen CT exams, with E being overestimated on average by 3.3% when no TCM is simulated. Also for organ doses a significant difference ($p < 0.001$) was found with an average overestimation of 13.7% for the breast, 7.3% for the lungs, 9.1% for the liver and 8.5% for the stomach but an underestimation of 11.5% for the ovaries when no TCM is used. No trend was observed as a function of patient BMI for the difference between both methods.
Conclusion: The new version of CT-Expo that accounts for TCM showed statistical significant differences in terms of E and organ doses when compared

to the previous version using only the average mAs. Future development could use patient specific TCM profiles and patient size specific conversion factors.

B-0248 15:03

Efficacy of lens protection systems in cranial CT-scans: dependency on different scanning techniques

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Purpose: The purpose of this phantom study was to evaluate the potential dose-attenuation of different eye lens protectors for patients undergoing various cranial CT-scans at different scanners.
Methods and Materials: Radiation exposure of the eye lens of seven common CT-Algorithms at 2 different CT-scanners (SOMATOM® Definition AS (CT 1) and SOMATOM® Definition Flash (CT 2) was measured with thermoluminescence dosimeters (TLD-500, α-Al2O3:C) using two different lens protectors (Somatex (SOM) and Medical-Imaging-Systems (MIS)).
Results: Dose attenuation accomplished by the different lens protectors is summarised as follows: for CT 1 (a) unenhanced CT (nCT) with gantry angulation: SOM (0%), MIS (0%); (b) CT-angiography (CTA): SOM (37%), MIS (9%); (c) CT-perfusion (CTP): SOM (61%), MIS (64%); for CT 2 (d) nCT without gantry angulation: SOM (19%), MIS (9%); (e) CTA Safire®: SOM (61%), MIS (26%); (f) dual-energy-CTA without Safire®: SOM (31%), MIS (7%); (g) CTP: SOM (56%), MIS (31%). Depending on the CT protocol but independent from the scanner used, lens protector SOM attenuated the dose up to 1.9 times more effectively compared to MIS. Physical analysis revealed that the two lens protectors differ with respect to their density and thickness.
Conclusion: The efficacy of the two evaluated lens protectors differs widely due to various material properties but is also highly dependent on the applied CT-protocol. Lens protectors are most effective in CTA protocols when reducing direct dose exposure. Considering both CT protocol and material of the lens protectors is mandatory to reduce radiation exposure of the eye lens of patients undergoing CT-scans.

B-0249 15:12

One-stop-shop myocardial 256-slice CT examination: what about the cumulative radiation risk?

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Purpose: To determine a) individual-specific estimates of radiation burden and associated radiogenic cancer risks associated with myocardial 256-slice coronary CT angiography (CCTA), dynamic CT perfusion (CTP) and delayed enhancement CT (DECT) scans, and b) the total life attributable risk (LAR) of radiation-induced cancer in individuals subjected to cardiac one-stop-shop 256-slice CT examination.
Methods and Materials: The typical 256-slice CCTA, dynamic CTP and DECT scans were simulated using Monte Carlo methods on sixty-two adult individuals using an advanced simulation software, dedicated for patient CT dosimetry. Radiation absorbed doses were determined to primarily exposed radiosensitive organs from each scan. Organ/tissue-specific radiogenic cancer risk factors were used to derive individual-specific LARs of cancer. The mean total LAR from the CCTA+CTP+DECT scans' sequence was estimated and compared to nominal intrinsic risk of cancer.
Results: The mean cumulative risk of radiogenic cancer associated with the complete one-stop-shop cardiac 256-slice CT examination was found to marginally increase the intrinsic risk for cancer induction by less than 0.6% in females and less than 0.1% in males. The CTP scan was found to be the main contributor to cumulative radiation burden from the 256-slice CCTA+CTP+DECT scan-sequence. The 256-slice CTP+DECT scan combination was found to be more dose-efficient compared to radionuclide myocardial perfusion imaging.
Conclusion: The theoretical radiation cancer risks associated with the one-stop-shop myocardial 256-slice CT examination may be considered low. Nevertheless, every effort should be made towards acquisition protocol optimisation for the dynamic CTP study which is the main contributor to patient radiation burden.

14:00 - 15:30 **Room N/O**

Vascular

SS 215

Developments in CT imaging

Moderators:
M. Das; Maastricht/NL
K. Nikolaou; Munich/DE

B-0250 14:00

Foot perfusion CT in patients with peripheral arterial occlusive disease treated with prostanoid drug: a pilot study

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Purpose: To evaluate the effectiveness of treatment with prostanoid drug (iloprost) in patients with PAOD using foot perfusion multidetector-row computed tomography (MDCT) technique.
Methods and Materials: After institutional review board approval and informed patient consent were obtained, 10 patients with PAOD, older than 65 years, were prospectively enrolled. All patients underwent dynamic foot 64-row-CT examinations before and after daily iloprost infusion for one week, acquiring 8 contiguous 5-mm reconstructed sections, with 1-second gantry rotation time and 60-second acquisition time, during injection of 40 mL of contrast medium (Iomeprol 400 mgI/mL, @ 4 mL/sec). Data were analysed by two experienced blinded readers using a dedicated software to calculate perfusion parameters, such as blood flow (BF), blood volume (BV), mean transit time (MTT), and permeability-surface area product (PS), before and after medical therapy. Interobserver and intraobserver agreement of perfusion CT analysis were assessed by Bland-Altman analyses. Perfusion parameters changes after prostanoid therapy were assessed by Wilcoxon's test, compared to clinical and laboratoristic evaluation.
Results: A good interobserver and intraobserver agreement of perfusion CT analysis was obtained in all patients (> 0.89). By comparing perfusion parameters after prostanoid treatment, a significantly shorter MTT was obtained, with good concordance with clinical results.
Conclusion: Foot CT perfusion, by providing the functional foot microvasculature, could be an useful method to evaluate the effectiveness of prostanoid therapy in patients with PAOD.

B-0251 14:09

Virtual monochromatic spectral image reconstruction in dual energy CT angiography and its use to reduce iodine load

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Purpose: To quantify the benefits concerning image quality of dual energy CT angiography (DECTA) with virtual monochromatic spectral (VMS) image reconstruction in comparison to standard CT angiography (CTA), and to test if these benefits can be used to reduce iodine load.
Methods and Materials: Ninety patients were randomised to three CT protocols: CTA with injection of 100 ml contrast media with 350 mg/ml iodine, DECTA with the same iodine load, and DECTA with reduced (75%) iodine load. Nine series of VMS images were reconstructed (40-120keV). Signal intensity (SI) and noise were measured in the aorta, musculature and fat, and SNR and CNR values were calculated.
Results: Image reconstruction at 80 keV revealed best SNR and CNR values. DECTA with 350 mg/ml iodine and image reconstruction at 80keV showed higher SNR and CNR values compared to standard CTA (SNR aorta: 11.05 vs. 8.2; CNR aorta-fat: 16.8 vs. 11.9; $p < 0.05$). Image reconstruction of DECTA with reduced iodine load at 80 keV showed higher SNR and CNR values compared to CTA (SNR aorta: 12.7 vs. 8.2; CNR aorta-fat: 20.0 vs. 11.9; $p < 0.05$), but significant lower SI values of the aorta (215.1 vs. 270.7). Image reconstruction of DECTA with reduced iodine load at 70 keV showed similar SI values of the aorta (272.3 vs. 270.7) but still higher SNR and CNR values (SNR aorta: 11.4 vs. 8.2; CNR aorta-fat: 17.1 vs. 11.9; $p < 0.05$) compared to CTA.
Conclusion: DECTA with VMS image reconstruction allow to improve CNR and SNR, and to reduce iodine load compared to standard CTA.

B-0252 14:18

Flash-4D CT angiography in aortic dissection

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Purpose: To assess feasibility and diagnostic value of Flash-4D CT angiography (CTA) for aortic dissection (AD).
Methods and Materials: 18 consecutive patients with known or suspected AD (age:30-76 years) referred for aortic CTA were scanned on a dual-source CT scanner (Somatom Definition Flash, Siemens) using a high-pitch mode (pitch = 3.0) with an automatic selection of kilovoltage that proposes optimised kV and mA settings according to planned examination type (Care KV; Siemens Healthcare) for multiphasic image acquisition (range from the entrance of bony thorax to the plane of symphysis pubis, time resolution 12s, 4 phases). CT densities were measured in the aortic lumen and renal parenchyma.
Results: In all cases Flash-4D CTA can exactly display the true and false lumen, intimal flap, the entry tear and the involvement of branches of AD. Mean radiation dose was 11.6 ± 1.61 mSv. CT density of true lumen peaked at 407.6 ± 89.1 HU, signal-to-noise ratio was 17.2±7.83. Compared to standard tri-phasic protocol (un-enhanced, arterial and portal scans), additional diagnostic information was also obtained as followed: enhancement delay between true and false lumen (n=18); the degree of membrane oscillation (n=16); perfusion delay in arteries originating from the false lumen (n=9) and quantitative assessment of renal perfusion asymmetry (n=3).
Conclusion: Flash-4D CTA covering the entire aorta is feasible and can exactly reveal pathological and anatomical features of AD with relative low radiation dose. Compared to standard tri-phasic protocol, it can provide more diagnostic information, which can be helpful for the selection of treatment methods.
Author Disclosures:
X. Zhang: Employee; Siemens Shanghai Medical Equipment Ltd.

B-0253 14:27

Impact of the hybrid iterative reconstruction technique on image quality of low-tube-voltage CT pulmonary angiography

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Purpose: To determine the impact of a hybrid iterative reconstruction (HIR) technique (iDose, Philips Healthcare) on image noise and image quality in low-tube-voltage and dose-reduced CT pulmonary angiography (CTPA) in comparison to filtered back projection (FBP).
Methods and Materials: 50 patients (mean body weight, < 80 kg) with suspected pulmonary embolism (PE) underwent CTPA with 80 kV protocol (Brilliance iCT; means: CTDIvol 2.3 mGy; DLP: 73.1 mGy*cm; effective dose: 1.2mSv). Raw data were reconstructed using FBP and three HIR levels (2, 4 and 6). Two radiologists assessed image quality and noise on a scale of 1 (poor) to 5 (excellent). Conspicuity of PE was assessed in central, segmental and subsegmental arteries using a three-point scale (1, subtle; 2, sufficient; 3, excellent). CT attenuation of pulmonary arteries, objective image noise (OIN) and background signal was measured, contrast-to-noise ratios (CNR) were calculated. Statistical analysis was performed using a random intercept model.
Results: With each HIR level, a significant decrease in subjective and objective noise was achieved. In comparison with FBP, the lowest OIN was achieved with HIR level 6 (means: 36.7 HU vs. 23.1 HU, respectively). CNR significantly increased with application of HIR whilst CT attenuation in pulmonary arteries maintained constant. Image quality was rated significantly higher at HIR 2, 4 and 6 (means: 3.8, 4.7 and 4.7, respectively) compared to FBP (mean: 3.3). Conspicuity of central and segmental PE improved with use of HIR.
Conclusion: The HIR technique reduces image noise, improves image quality and conspicuity of PE in 80 kV CTPA protocols.

B-0254 14:36

Acute limited dissection (class 3) of the aorta diagnosed with EKG-gated CT angiography: a 10-year single center experience

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Purpose: Limited dissection (LD) is notoriously difficult to diagnose prospectively, reported to elude all cross-sectional imaging techniques. ESC Task Force classifies LD as "class 3" aortic dissection, but this entity remains largely unknown to radiologists. We have identified LDs at our institution on ECG-gated CTA prospectively with surgical/pathologic confirmation. Our aim is to evaluate the ability of state-of-the-art CTA to detect LD in the clinical setting of acute aortic syndrome (AAS) and describe CTA imaging characteristics.
Methods and Materials: CTAs from Jan 1, 2002 - Dec 31, 2012 in patients presenting with AAS were retrospectively reviewed by two cardiovascular radiologists. LD was diagnosed according to ESC classification and Svensson's 1999 original angiographic description "subtle aortic contour bulge without frank dissection flap." Additional post-processing was performed to increase lesion conspicuity.
Results: Incidence of LD was 4.9% (25 LD, 291 classic dissection, 123 IMH, 29 penetrating atherosclerotic ulcer, 7 iatrogenic, 3 mycotic and 33 rupturing aneurysm). Of 25 acute LDs, there were 17 type A and 8 type B (2 arch, 6 descending aorta). There was 100% surgical/pathological concordance with pre-operative CTA diagnosis in 10/17 type A LDs who underwent urgent surgery. One type B LD was "missed" on initial review.
Conclusion: Accurate detection of LD is possible using ECG-gated CTA, although lesion awareness and meticulous dataset review is required; additional post-processing increases lesion conspicuity. This is a first report of prospective CTA diagnosis of LD, and the first to report type B LD using CTA.

B-0255 14:45

Feasibility study of CT-angiography with low kV settings and ultra low-contrast medium volume in the assessment of thoracic and abdominal aorta disease

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Purpose: To assess the diagnostic quality and the radiation dose exposure of low-kV CT angiography study (100 kV),by using ultra low-contrast medium volume (40 mL), for thoracic and abdominal aorta evaluation.
Methods and Materials: From July 2011 to march 2013, 81 patients (31 women; mean age 65.4 years; range, 35-83 years; BMI< 30),with thoracic or abdominal aortic disease, were prospectively examined with 256-MDCT scan (Brilliance iCT; Philips) using low-dose protocol (100 kV; automated tube current modulation) and ultra low-contrast volume (40 mL; 4 mL/s; 350 mgI/mL). For the evaluation of ascending aorta, an ECG-gated retrospective protocol was performed. A control group of 56 patients (20 women; mean age 67.2 years; range, 34-86 years) who underwent on the same scanner standard CT-angiography protocol (120 kV; 350 mAs), with standard contrast volume (100 mL) was also evaluated. Density measurements were performed manually drawing a region of interest (ROI) on lumen of ascending aorta, arch, descending and abdominal aorta, renal arteries and common iliac arteries. The radiation dose exposure (dose-length product, DLP) was also calculated for both groups. Then, the obtained data were compared and statistically analysed.
Results: In all CT studies, we could correctly visualise and evaluate main branches of thoracic and abdominal aorta. No significant difference of density measurements was achieved between low-kV protocol (mean attenuation value of thoracic aorta 310 HU, abdominal aorta 337 HU and renal arteries 329 HU) and the control group (mean value of thoracic aorta 316 HU, abdominal aorta 331 HU and renal arteries 307 HU).The radiation dose exposure was significantly lower ($p < 0.05$) in low-kV protocol (mean DLP thoracic 490 mGy*cm; abdominal 335 mGy*cm) than in control group (mean DLP thoracic 625 mGy*cm; abdominal 952 mGy*cm), with an overall reduction of 22% in the thoracic and 65% for abdominal study.
Conclusion: Low-kV protocol provides a diagnostic performance comparable to standard protocol, decreasing significantly the radiation dose exposure as well as the contrast material volume, reducing also the risk of contrast-induced nephropathy.

B-0257 14:54

CTA imaging characteristics of rupturing thoracic aortic aneurysm in acute aortic syndrome: a 10-year single center experience

A.S. Chin, A. Kino, D. Fleischmann; *Stanford, CA/US (annechin@stanford.edu)*

Purpose: The incidence of leaking or rupturing thoracic aortic aneurysm is largely unknown as many succumb before coming to medical attention. Our aim is to evaluate the incidence of leaking/rupturing aortic aneurysm presenting as *acute aortic syndrome* (AAS) and describe CTA imaging characteristics.
Methods and Materials: CTAs from Jan 1, 2003 - Dec 31, 2012 in patients with AAS were retrospectively reviewed by two cardiovascular radiologists. Leaking/rupturing aneurysm was diagnosed based on aortic diameter greater than 40 mm AND (1) contrast extravasation, (2) pseudoaneurysm formation, or (3) other imaging finding indicating acute aortic injury including periaortic hematoma, intramural hematoma or mediastinal hemorrhage.
Results: 511 patients were diagnosed with AAS with 6.5% incidence of rupturing thoracic aneurysm (291 classic dissection, 123 IMH, 25 limited dissection, 29 penetrating atherosclerotic ulcer, 7 iatrogenic, 3 mycotic and 33 rupturing aneurysm). There was 87.9% (29/33) descending involvement. 20/33 patients underwent surgical or endovascular treatment with 15% in-hospital mortality versus 38.5% in-hospital mortality with conservative management.
Conclusion: Leaking or rupturing thoracic aneurysm represents a significant portion of patients presenting with AAS, comparable to penetrating atherosclerotic ulcer in our series, and most frequently involves the descending aorta.

B-0258 15:03

Low-dose 256-MDCT angiography of the carotid arteries: effect of hybrid iterative reconstruction technique on noise, artefacts, and image quality

E. Kondratyev, G.G. Karmazanovsky, V. Shirokov, N. Tarbaeva, A. Vishnevskaia; *Moscow/RU (evgenykondratiev@gmail.com)*

Purpose: To evaluate the effect of hybrid iterative reconstruction on qualitative and quantitative parameters at low-dose carotid CTA
Methods and Materials: 44 consecutive patients were enrolled in the study. First group (n=22) was examined under 120 kV 250 mAs and second group (n=22) under 100 kV 250 mAs. CT images in first group were reconstructed only with the filtered back projection (FBP). CT data in second group were reconstructed both with FBP and three levels of hybrid iterative reconstruction algorithm (iDose). We compared quantitative and qualitative parameters among the two groups and among four different reconstructions in second group.
Results: Effective dose in 120 kV and 100 kV group was 7.18±1.19 mSv and 4.14±1.03 mSv, respectively ($p < 0.0001$). Mean arterial attenuation was about 25% higher in second group (236.5±46 vs. 302.6±32.7 HU; $p < 0.0001$). Image noise at the level of humeral belt was 32.5±12.5 in 100 kV group and 26.3±13.3 in 120 kV (p=0.115. Average noise decreased when using 3 levels of iDose up to 23.6±6.4, 17.7±5.6, 13.7±5.1, respectively (p=0.00001). Mean CNR increased to 10.38±3.87, 14.5±5.21, 18.32±8.61, respectively ($p < 0.05$). The presence of artifacts on the level of humeral belt in 120 kV group was 14%, in 100 kV - 41% (p=0.002). The difference in visual scores between standard and low-dose protocol was significant (p=0.008). When applying iterative reconstruction, the frequency of streak artifacts decreased dramatically ($p < 0.0001$). Most studies had excellent quality with no artefacts while using highest level of iDose.
Conclusion: Low-dose MDCT angiography using hybrid iterative reconstruction may provide sufficient image quality and allows for significant reduction of patient dose.

B-0259 15:12

Comparison between CT venography at 320 multi-detector row scanners with conventional angiography in patients with failed arteriovenous axis for haemodyalysis

Y. Ragab[1], H. Hamza[2], A. El Marakby[1], F. Zeinhohm[1]; [1]*Cairo/EG*, [2]*Doncaster/UK (hosnyhamza71@gmail.com)*

Purpose: To compare CT venography at 320 multi-detector row scanners with conventional angiography in patients with failed arteriovenous axis for haemodyalysis.
Methods and Materials: retrospective study including 50 ptients with failed arteriovenous axis for haemodyalysis (37 men, 13 women) who underwent 320 multi-detector CT venography of the thoracic inlet prior to angioplasty. Findings on CT angiograms, including CT scans, maximum intensity projections, and three-dimensional volume-rendered images, were used to evaluate the site and cause of axis failure.
Results: Among the 50 patients initially treated with venous angioplasty, 56 venous occlusions were identified. In 94% of cases, concordant findings were observed with both modalities (CTV and conventional venography). In five (6%)cases, CT could not be used to identify precisely the site of venous obstructions. In 5% cases, CT depicted venous tight stenoses that could not be tackled by angioplasty. Three-dimensional images were found to be superior to 2D CT angiogrphic in depicting the anatomical venous anomalies which enabled the interventional radiologists to perform successful angioplasty after direct catherization.
Conclusion: CT venography using 320 multi-detector systems provides more accurate depiction of the venous anatomy of the thoracic inlet prior to conventional venography and angioplasty.

14:00 - 15:30 **Conf. Room M3**

Interventional Radiology

SS 209

MR-guided high-intensity focused ultrasound

Moderators:
N. Grenier; Bordeaux/FR
C.M. Sommer; Heidelberg/DE

B-0260 14:00

Reintervention rate and symptom improvement following volumetric MR-guided high-intensity focused ultrasound versus uterine artery embolisation for uterine fibroids: a multicenter study

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Purpose: To assess the effectiveness of MR-guided High-Intensity Focused Ultrasound (MR-HIFU) for treatment of uterine fibroids in comparison to Uterine Artery Embolisation (UAE).
Methods and Materials: Between January-2011 and January-2013, 51 women with symptomatic fibroids underwent MR-HIFU in the UMC Utrecht. Clinical and imaging data were compared to 68 women treated with UAE in the St.Elisabeth Hospital Tilburg, those who would theoretically been eligible for MR-HIFU based on fibroid size (≤12 cm) and number (≤5), absence of interposed intestines and other pelvic diseases. We compared reintervention within 12-months following treatment; symptom severity (tSSS) and quality of life (HRQoL) scores 3-months after initial treatment. Logistic regression was performed to calculate the adjusted Odds-ratio of clinically relevant symptom improvement (defined as 3-months tSSS≤20) of women treated with MR-HIFU versus UAE. Cox regression was applied to calculate the adjusted risk of reintervention between both groups.
Results: After MR-HIFU, the median tSSS improved from 53.1 (IQR [40.6.68.8]) at baseline to 34.4 (IQR [21.9.46.9]) after 3-months ($p < 0.001$). After UAE, median tSSS improved from 65.3 (IQR [56.3.74.2]) to 21.9 (IQR [9.4.34.4]; $p < 0.001$). For both groups, HRQoL improved significantly from baseline to follow-up ($p < 0.001$). Compared to UAE, women treated with MR-HIFU were less likely to develop adequate symptom improvement (OR=0.07; 95%-CI [0.02.0.29]; $p < 0001$). At 12-months, patients treated with MR-HIFU had a 7.11 (95%-CI [2.00.25.3]; p=0.002) times higher risk of reintervention.
Conclusion: Women with symptomatic uterine fibroids had a higher probability of adequate symptom improvement and a lower risk of reintervention if treated with UAE as compared to MR-HIFU.

B-0261 14:09

New fronteers for the multiple uterine fibroids therapy: combined treatment using MRgFUS and uterine artery embolisation

F. Ferrari, A. Miccoli, F. Arrigoni, S. Carducci, A. Giordano, G. Mascaretti, C. Masciocchi; *L'Aquila/IT (fabianaferrari@hotmail.it)*

Purpose: To evaluate the combination between magnetic resonance-guided focused ultrasound (MRgFUS) and uterine artery embolisation (UAE) to increase the number of patients, affected by multiple uterine fibroids, treatable by non-surgical therapy.
Methods and Materials: From December 2012 to September 2013, 6 patients with multiple uterine fibroids, aged between 36 and 51, were first treated by MRgFUS and after 1 month using UAE. Each patient presented more than 3 fibroids, measuring between 3 and 14 cm. Four patients had 4 fibroids, 1 of these was treated using MRgFUS and the others with UAE. Two patients presented 3 fibroids, 2 treated by MRgFUS and the others using UAE. The use of UAE after MRgFUS caused an increase of the necrotic area in fibroids already treated, improving the treatment efficacy, and allowing the treatment of fibroids otherwise untreatable by MRgFUS. Each patient was subjected to clinical evaluation using the severity-score-questionnaire.
Results: We obtained a good response in both treatments, without any complication. The "non perfused volume" showed a mean value of 86.5% in fibroids treated with MRgFUS, and a mean value of 90% for fibroids treated with UAE. The symptomatic score showed a reduction of about 90%, if compared to the pre-treatment score.
Conclusion: These combined treatments imply minimal hospitalisation and complications preserving uterus integrity when the invasive surgery would be the only therapeutic possibility.

B-0262 14:18

Osteoid osteoma: magnetic resonance-guided high intensity-focused ultrasound for entirely non-invasive treatment: a prospective developmental study

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Purpose: To determine the efficacy of MR-guided focused ultrasound (MRgFUS) treatment of symptomatic osteoid osteomas.
Methods and Materials: This prospective, IRB approved study involved 15 consecutive patients (11 m, 4 f, mean age 21) with clinical and imaging diagnosis of osteoid osteoma, all patients underwent MRgFUS ablation (ExAblate, InSightec). Lesions located in the vertebral body were excluded, while lesions in proximity to joints or neurovascular bundles were included. Treatment success was determined at clinical and imaging follow-up at 1, 6 and 12 months post-treatment. A visual analogue pain score was used to assess changes in symptoms. Bone changes at nidus site were evaluated on the basis of CT and dynamic ce-MR imaging (Gd-Bopta; Bracco) pre- and post-treatment.
Results: Treatment was carried out using a variable sonications number (4±1.8) with a mean energy deposition of 866±211 J. There were no treatment or anesthesia-related complications. A statistically significant difference (p=0.001) was noted between pre- and post-treatment VAS scores (8.3±1.6 vs 0.6±1.5, respectively). Two treatments were conducted in patients with prior CTgRFA failure and needed two different sessions to achieve complete clinical success. At imaging, edema and hyperemia gradually disappeared in all lesions. No apparent relationship between nidus vascular extinction and successful outcome was found. Variable reabsorption degree of sclerotic reaction was observed with nidus disappearance in 4 cases (27%).
Conclusion: Treatment of osteoid osteoma using MRgFUS can be performed safely with high rate of success and without treatment-related morbidity. Our results also indicated a positive trend to bone rearrangement after treatment.

B-0263 14:27

Our experience of non-invasive treatment of epiphyseal benign bone lesions using MRgFUS: can it really be a definitive solution?

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Purpose: To evaluate the role of MRI-guided focused ultrasound (MRgFUS) in the treatment of epiphyseal benign bone lesions in which the surgery would be too demolitive.
Methods and Materials: From March 2011 to August 2013 we treated 12 epiphyseal benign bone lesions: seven fibro-osteitis (four of the humerus; two of the foot; one of the knee), two periosteal chondroma of the femoral neck, two fibromixomas of the knee and one osteoblastoma of the femoral neck. All patients were studied by CT and MRI and evaluated by VAS scale, for the clinical symptoms before and after (6 and 12 months) treatment. The nature of all the lesions was confirmed by biopsy.
Results: After the treatment all patients, except one, showed regression in painful symptomatology with mean VAS that decreased from 7.8 to 2.5. In the patient with periosteal chondroma of the femoral neck no improvement in symptomatology was observed. At the MRI and CT evaluation after treatment, in no case a progression of disease was described. No substantial changes were found in the CT images of controls. Instead, in the MRI evaluations, in all the lesions, there was the reduction of bone edema around the lesion already to the first control at 6 months. In no case major complications were observed.
Conclusion: Though further and larger studies are needed our experience shows that the use of MRgFUS is a safe and effective treatment for those lesions in which the surgery would be too invasive in relation with the grade of lesions.

B-0264 14:36

Magnetic resonance-guided focused ultrasound surgery (MRgFUS) treatment of painful bone metastases: can ADC value predict the clinical outcome?

F. Boni, F. Zaccagna, A. Napoli, V. Noce, L. Bertaccini, C. Catalano; *Rome/IT (fabrizioboni00@gmail.com)*

Purpose: To evaluate the role of ADC values in the assessment of bone metastasis' response after MR-guided focused ultrasound surgery (MRgFUS), and to correlate these modifications with clinical outcomes.
Methods and Materials: 23 patients with bone metastases underwent MRgFUS treatment (ExAblate2100,InSightec). Lesion's size and locations were determined using CT and MRI; all MRI scans were performed with a 3 T unit paired with the ExAblate system. Treatments were performed under general anaesthesia or subarachnoid spinal block. Follow-up examinations were performed 1, 3 and 6 months after treatment; pain severity and pain interference were evaluated using a Visual Analogue Scale, meanwhile imaging assessment was performed by comparing pre- and post-treatment ADC values.
Results: All patients well tolerated the treatment and no heating-related adverse events were recorded. The VAS score decreased from baseline 7.09±1.8, to 2.65±1.36 at first follow-up and 1.04±1.91 at third month follow-up; at sixth month, it was stable (1.09±1.99). ADC values increased of +48.9% at first month follow-up ($p < 0.001$), and it was stable in the following examinations (43.3% at 3 months and 42.8% at 6 months). Moreover, there was a statistically significant negative correlation between ADC and VAS (ρ=-0.684; p=0.03).
Conclusion: Preliminary data showed that an increment in ADC values is strongly associated with pain relief after MRgFUS treatment in patients with bone metastases; moreover, we also demonstrated a different percentage of increase in ADC values according to response assessment. Therefore, in conclusion, ADC value could play an important role in outcome prediction in patients undergoing MRgFUS for painful bone metastasis.

B-0265 14:45

Primary pain palliation and local tumour control in bone metastases treated with MR-guided focused ultrasound

F. Zaccagna, B. Cavallo Marincola, A. Napoli, F. Boni, G. Brachetti, L. Bertaccini, C. Catalano; *Rome/IT (f.zaccagna@gmail.com)*

Purpose: To evaluate the clinical performance of MRgFUS in the primary treatment of painful bone metastases and to explore the potential of this technique in achieving local control.
Methods and Materials: 26 consecutive patients (female/male 12/14; age: 64.7±7.5) with painful bone metastases were enrolled in this study. Before and 3 months after MRgFUS treatment, pain severity and pain interference scores were assessed according to Brief Pain Inventory-Quality of Life (BPI-QoL) criteria and patients underwent both CT and MRI. Local tumour control was evaluated according to lesion size, density and perfusion at CT, dynamic contrast enhancement at MRI (Discovery 750HD, GE; Gd-Bopta, Bracco) and metabolic activity at PET or scintigraphy. Patients were classified into responders and non-responders.
Results: No treatment-related adverse events were recorded during the study. A statistically significant difference between baseline and follow-up values for both pain severity and pain interference scores was observed ($p < 0.05$). Increased bone density was observed in 9/26 (34.6%) patients. Non-perfused volume values ranged between 20% and 92%. There was no difference in NPV values between responders and non-responders (46.7±24.2% [25 - 90 %] vs. 45±24.9% [20 - 93 %]; p=0.7). In 6 patients (5 prostate and 1 breast primary cancer), there was nearly absence of metabolic activity after treatment (mean SUV=1.2).
Conclusion: MRgFUS can be safely and effectively used as the primary treatment for pain palliation in patients with bone metastases; our experience demonstrated also a potential role for the MRgFUS in local tumour control as confirmed by metabolic analysis.

B-0266 14:54

Magnetic resonance-guided focused ultrasound surgery (MRgFUS) treatment of primary pancreatic and hepatic cancer: preliminary experience in tumour control

F. Zaccagna, F. Boni, L. Bertaccini, V. Noce, M. Anzidei, A. Napoli, C. Catalano; *Rome/IT (f.zaccagna@gmail.com)*

Purpose: Hepatic tumours (HCC) and pancreatic cancer represent two of the most challenging abdominal tumours due to their vascular relationship and to the poor prognosis. Both these cancers have been successfully treated with focused ultrasound under conventional US guidance. Magnetic resonance-guided focused ultrasound surgery (MRgFUS) introduces the advantage of real-time monitoring, allowing a more precise lesion's ablation and a more accurate in-treatment patient management. This technique has been widely used in other applications while its use to treat HCC and pancreatic cancer is still in its preliminary phase. Therefore, our purpose was to evaluate safety and effectiveness of high-intensity MR-guided focused ultrasound treatment in pancreatic and HCC.
Methods and Materials: 5 patients with pancreatic cancer and 1 with unresectable right lobe HCC underwent MRgFUS treatment (ExAblate2100, InSightec). Treatments were done in a single ambulatory session. To evaluate tumour control, perfusion T1w images after contrast medium administration were obtained pre- and post-treatment. Follow-up examinations were scheduled at 1, 3, 6 and 12 months.
Results: All patients well tolerated the treatment and no heating-related adverse event was recorded. Immediately after treatment, all patients showed coagulative necrosis with a mean non-perfused volume of 65.4±16.6 [45 - 90]. All patients with pancreatic cancer showed a significant decrease of pain. At follow-up, no local progression was recorded; after MRgFUS 2 patients with pancreatic cancer underwent RT meanwhile another one required a second MRgFUS treatment.

Conclusion: Our preliminary experience indicates that MRgFUS could be a promising non-invasive treatment modality in patients with unresectable pancreatic cancer and HCC.

B-0267 15:03

Role of magnetic resonance-guided high intensity focused ultrasound (MRgFUS) surgery as non-invasive treatment of breast cancer in patients with focal disease

A. Napoli, V. Noce, L. Di Mare, M. Anzidei, F. Pediconi, L. Bertaccini, C. Catalano; *Rome/IT*

Purpose: To assess safety and feasibility of 3 T MR-guided focused ultrasound (MRgFUS) ablation of invasive ductal breast cancer (stage T1 M0 N0) prior to surgical resection and sentinel lymph node biopsy. As secondary outcome, we evaluated MRI accuracy in the assessment of residual disease.
Methods and Materials: Eleven patients with unifocal biopsy-proven IDC, scheduled for lumpectomy and sentinel lymph node biopsy, underwent MRgFUS treatment. Pre-treatment imaging was performed on a 3 T MRI unit to localise the enhancing lump and to evaluate treatment's feasibility according to its size (< 2 cm) and location. All patients underwent MRgFUS treatment (ExAblate 2100; InSightec) in a day-surgery setting. Immediately after the treatment, a contrast-enhanced MRI (CE-MRI) was performed to evaluate treatment response; post-surgery pathological evaluation was considered as reference standard to assess treatment's efficacy.
Results: All patients well tolerated the treatment and no heating-related adverse event was recorded. At post-treatment CE-MRI, no enhancing lesion was seen in 9 patients; in these patients, post-surgery pathological evaluation demonstrated an area of necrosis with 5-mm margins of normal breast tissue and no foci of residual disease. In the remaining 2 cases, treatment was interrupted due to a transducer's malfunction; CE-MRI demonstrated a fainting enhancement and post-surgery pathological evaluation showed a 15% of residual tumour in the ablated area. Post-treatment CE-MRI assessment of residual tumour was strongly correlated to post-surgery pathological evaluation of treatment response.
Conclusion: MRgFUS is an innovative and totally non-invasive treatment modality for unifocal breast cancer that allows a safety and efficacy treatment due to MR guidance.

B-0268 15:12

Non-invasive focal therapy of organ confined prostate cancer: phase-I study using magnetic resonance guided focused ultrasound technology and excision pathology for efficacy assessment

D. Pier Luigi, A. Napoli, F. Zaccagna, G. Cartocci, F. Boni, V. Noce, V. Noce, C. Catalano; *Rome/IT (f.zaccagna@gmail.com)*

Purpose: To assess safety and effectiveness of non-invasive MR-guided focused Ultrasound Surgery (MRgFUS) treatment of localised prostate cancer in a phase-I, treat and resection designed exploratory study.
Methods and Materials: 11 patients with biopsy proven focal T2 prostate cancer (low-to-intermediate risk: PSA< 12 and Gleason< 3+4), confirmed on a previous multiparametric MRI including dynamic contrast enhanced (DCE) imaging (Gd-BOPTA, Bracco), underwent MRgFUS ablation (ExAblate, InSightec). All patients were scheduled to radical laparoscopic prostatectomy. MRgFUS treatment was carried out on the MR identifiable lesion (< 2) using a patient specific energy (3000-8500 J) and real- time MR thermometry. Non-perfused volume (NPV) in the post-treatment MRI was compared with excision pathology for necrosis assessment.
Results: No significant complications were observed in all subjects during or immediately after the procedure. Treatment was validated by pathological examinations, which demonstrated extensive coagulative necrosis at the site of sonication surrounded by normal prostatic tissue with inflammatory changes; these features were positively correlated with the immediate post-treatment MRI scan and NPV values. At histology, 10 patients were free of residual viable tumour within the treated area; in the remaining patient, 10% of residual tumour was observed within the NPV. There was a variable amount of isolated cancer tissue (Gleason< 6, 3+3) within non-treated parenchyma that was neither identifiable at MRI nor at biopsy.
Conclusion: Results of our Phase-I study suggest that MRgFUS is a safe and effective modality to determine a > 90% necrosis of identifiable prostate cancer; other prospective studies are needed to extend success rate in larger cohort.

B-0269 15:21

Image-guided high-focused ultrasound for renal sympathicolysis: a feasibility study in pigs

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Purpose: To evaluate feasibility, safety and efficacy of MR-guided high-focused ultrasound (MRgHiFUS) for renal sympathetic denervation in pigs.
Methods and Materials: Renal periarterial MRgHiFUS was performed under general anaesthesia in 10 pigs (unilaterally in 9 pigs, sham treatment in 1 pig). Blood pressure measurements and MRI of the kidneys, renal arteries and surrounding structures were acquired immediately pre- and post-intervention and after 4 weeks. Hereafter, all animals were killed to histologically examine induced neural degeneration and to assess efficacy of the procedure by determining norepinephrine (NE) concentration in the renal parenchyma.
Results: On average, 10.5±2.9 sonifications with a mean energy of 2671±446 Joule were applied. Post-interventional MRI revealed a periarterial oedema on the treated side in three pigs, corresponding histologic changes were found in one pig. Renal NE was lower (-8 to -27 %) on the treated side than on the untreated side in 5 of 7 unilaterally treated pigs. A significant difference in the average NE level between the treated (392 ng/g) and untreated kidneys (430 ng/g) of all unilaterally treated animals was not found. Post-interventional MRI indicated that special anatomic features led to ultrasound energy absorption at the transverse process and fascia.
Conclusion: MRgHiFUS did not induce significant renal sympathicolysis in a pig model, probably due to insufficient periarterial energy deposition. Since a HiFUS treatment in humans is expected to be easier to perform due to a better access to renal sympathetic nerve fibres, further studies of this method are desirable.

14:00 - 15:30 **Board Room A**

Radiographers

SS 214

Quality improvement in screening and symptomatic mammography services

Moderators:
C. Mandel; East Melbourne/AU
D. O'Leary; Dublin/IE

B-0270 14:00

Mammographic positioning quality of newly trained vs experienced radiographers in the Dutch breast cancer screening programme

C.G.C.M. van Landsveld-Verhoeven, J.M.H. Timmers, M.J.M. Broeders, G.J. den Heeten; *Nijmegen/NL (c.vanlandsveld-verhoeven@lrcb.nl)*

Purpose: To compare mammographic positioning quality of new (NR) versus experienced screening radiographers (ER).
Methods and Materials: Radiographers must complete an initial education course before starting to work in the Dutch breast screening programme. This course consists of a theoretical part (4 days) and a practical training period (6 weeks). A portfolio of 50 mammograms, randomly selected from screening practice, is part of the examination. Audits are part of the quality assurance programme and a review of positioning quality of screening mammograms is one of the activities performed. We analysed 7079 views from portfolios and 14896 audit views. All mammograms were reviewed based on pre specified criteria, e.g. depiction of the inframammary angle and nipple in profile.
Results: Positioning was more adequate for NR than ER (CC views: 96.5% versus 86.4%, p=0.00; MLO views: 91.9% versus 84.5%, p=0.00). Mammograms from ER were more often poor, because the errors were more severe. For the CC views, the NR scored better for most of the criteria: they had less problems with bucky height (5.6% versus 9.2%, p=0.00) and less lateral and medial folds compared to ER (10.4% versus 15.6%, p=0.00). On the contrary, for MLO views, NR encountered more difficulties, especially with the symmetry (12.0% versus 5.7%, p=0.00) and depiction of the inframammary angle without folds (68.3% versus 58.8%, p=0.00).
Conclusion: Overall, NR perform better than ER. These results stress the need for continuous auditing and training in breast cancer screening programmes to keep positioning skills up to date.
Author Disclosures:
G.J. den Heeten: Founder; Co-founder of Sigmascreening a spin off company of the Academic Medical Centre Amsterdam.

B-0271 14:09

Reject analysis for digital mammography (2D) including 2D plus tomosynthesis in high volume mammography screening

R. Hammond[1], R. Gullien[1], B. Østerås[1], I. Hauge[2]; [1]*Oslo/NO*, [2]*Østerås/NO (robham@ous-hf.no)*

Purpose: Reject rates and reasons for rejected images between digital mammography (2D) compared with 2D plus tomosynthesis in high volume mammography screening.
Methods and Materials: Reject analysis for an 18 month period included a total of 95,976 mammography images, 22,772 from 2D examinations and 73,204 from 2D plus tomosynthesis. For 2D plus tomosynthesis, one image is defined as both 2D and a tomosynthesis acquisition. Rejection rate was calculated on per image basis, presented with 95% Confidence Intervals (CI) estimated using the Wilson score method. Rejected images were assigned into categories for reasons: 1) positioning, 2) x-ray equipment failure, 3) patient motion, 4) artifacts and 5) others
Results: Total rejection rate for 2D was1.62% [CI: 1.46-1.79] (368/22772) and 2D plus tomosynthesis1.28% [CI: 1.20 - 1.37] (939/73204). Stratified rejection rate for categories: 1)positioning: 0.82% [CI: 0.71 - 0.95] vs. 0.69% [CI: 0.63 - 0.75]; 2)x-ray equipment failure: 0.60% [CI: 0.51 - 0.71] vs. 0.37% [CI: 0.33 - 0.42]; 3)patient motion: 0.066% [CI: 0.040 - 0.11] vs. 0.089% [CI: 0.070 - 0.11]; 4)artifacts: 0.022% [CI: 0.0094 - 0.051] vs. 0.041% [CI:0.029 - 0.058]; 5)others: 0.11% [CI: 0.071 - 0.16] vs. 0.092 % [CI: 0.072 - 0.12] for 2D and 2D plus tomosynthesis, respectively. Overall rejection rate was significantly higher for 2D compared with 2D plus tomosynthesis. Most common reasons for rejections were: Positioning and X-ray equipment failure.
Conclusion: Positioning is the most common reason for rejections. Tomosynthesis may be implemented in a high volume breast cancer-screening program without an increase in rejected images.
Author Disclosures:
R. Hammond: Advisory Board; Hologic, Inc. 2012. Other; Travel costs 2012, Hologic, Inc. **R. Gullien:** Other; Travel costs 2012, Hologic, Inc.

B-0272 14:18

Tomosynthesis in mammography screening: invited women's attitude regarding radiation health effects and pain experience

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Purpose: Comparing participants and non-participants responses when offered tomosynthesis in addition to 2D mammograms based on informed consent in a screening program.
Methods and Materials: From Sept.28th to Dec.12th 2012, 4609 women aged 50-69 attended a population-based screening program. 2922 women voluntary answered a questionnaire including questions about concern of radiation health effects and pain experience. Both participants and non-participants were asked to reply. Most questions were identical for both groups. 34 incomplete questionnaires were excluded.
Results: 82% (2367/2888) of participants and 18% (521/2888) of non-participants replied. There was no difference regarding level of education, self-assessment of knowledge of radiation, and previously history of mammography between the groups. 780 (33%) of participating and 133 (26%) of non-participating women had heard about tomosynthesis ($p < 0.05$). Of all repliers, 93.5% (2700/2888) were not/slightly concerned about radiation health effects. Among participants, 96% (2254/2367) were not/slightly concerned about radiation effects compared with 86% (446/521) among non-participants ($p < 0.05$). 75% (2178/2888) of all repliers experienced no/little pain during the examination, 77% (1821/2367) vs. 68% (357/521) for participants and non-participants, respectively. Of women receiving tomosynthesis, 75% (1785/2367) experienced no difference, 6% less, and 8% more pain compared with previous mammography. 91% (2148/2367) felt the examination-time was the same, and 91% (2144/2367) believed to have received a better examination.
Conclusion: The majorities of women choosing tomosynthesis had a low level of anxiety for adverse radiation health effects and believed they received a better examination. They didn't find tomosynthesis more painful or longer than a standard 2D mammogram.
Author Disclosures:
R. Gullien: Other; Travel costs and fees for one lecture in 2012, Hologic, Inc. **R. Hammond:** Advisory Board; Hologic, Inc. 2012. Other; Travel costs and fees in 2012 by Hologic, Inc. **P. Skaane:** Equipment Support Recipient; Hologic, Inc. Research/Grant Support; Financial support when overtime reading was necessary by Hologic, Inc.

B-0273 14:27

Reject analysis in high-volume mammography screening: comparison of image quality between rejected and replaced images

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Purpose: Compare image quality of retained images from multiple sets of rejected and repeated images using the classification system PGMI (Perfect, Good, Moderate, Inadequate).
Methods and Materials: From October 2011-December 2012, a total of 544 images were rejected by radiographers with the reason "positioning". 18 images were excluded due to incomplete information. All rejected and repeated paired images were given a PGMI score separately by an PGMI-radiographer. PGMI score for each image set was compared and placed into one of three categories, depending on the score of the retained image: Higher (H), Same (S) or Lower (L) PGMI score. For category S and L, further analysis were done on reasons for repeating an image.
Results: 67% (351/526) of the repeated had a higher PGMI score than the rejected images; 30% (159/526) had the same PGMI score; 3% (16/526) had a lower PGMI score. For category "S" rejected images: 9% (15/159) were CC and 91% (144/159) were MLO images. Category "L": 13% (2/16) of rejected images were CC and 87% (14/16) were MLO. Of the rejected images within categories "S" and "L", a total of 90% (158/175) were MLO. They were rejected for the reasons: a) pectoral muscle not to the nipple level 35% (56/158), b) folds in the inframammary fold 19% (30/158), c) nipple not in profile 13% (21/158), d) inframammary fold not visible 9% (15/158), e) others 3% (23/158).
Conclusion: Two thirds of the repeated images show improved image quality, but there is potential for improvement of rejected images.
Author Disclosures:
R. Hammond: Advisory Board; Hologic, Inc. 2012. Other; Travel costs and fees in 2012, Hologic, Inc. **R. Gullien:** Other; Travel costs and fees for one lecture in 2012, Hologic, Inc. **P. Skaane:** Equipment Support Recipient; Hologic, Inc. Research/Grant Support; Financial support when overtime reading was necessary by Hologic, Inc.

B-0274 14:36

Failure on clinical image quality criteria in digital mammography: how can radiographers do better?

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Purpose: To assess image quality using PGMI (perfect, good, moderate, inadequate) scale in digital mammography examinations acquired in DR systems. Identify the main failures and propose corrective actions. Evaluate the most typical breast density.
Methods and Materials: Clinical image quality criteria were evaluated considering mammograms acquired in 13 DR systems and classified according to PGMI scale using the criteria described in European Commission guidelines for radiographers. The breast density was assessed according to ACR recommendations. The data were collected on the acquisition system monitor to reproduce the daily practice of the radiographer.
Results: The image quality criteria were evaluated in 3044 images. The criteria were fully achieved in 41% of the images that were classified as P (perfect), 31 % of the images were classified as M (moderate), 20% G (good) and 9% I (inadequate). The main cause of inadequate image quality was absence of all breast tissue in the image, skin folders in the pectoral muscle and in the infra-mammary angle. The higher number of failures occurred in MLO projections (809 out of 1022). The most represented (36%) breast type was type 2 (25-50% glandular tissue).
Conclusion: Incorrect radiographic technique was frequently detected suggesting potential training needs and poor communication between the team members (radiographer and radiologists). Further correlations are necessary to identify the main causes for the failures, namely specific education and training in digital mammography and workload.

B-0275 14:45

Screening mammograms rejected due to positioning: does radiographer experience and type of employment matter?

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Purpose: Examine the dependence of rejection rate on experience and employment type.
Methods and Materials: From October 2011 to December 2012, a total of 85740 images were aquired. Of these images, 544 (0.63 %) were rejected for positioning reasons. Individual reject rates for 25 radiographers were calculated. Experience in mammography, less or more than five years, and type of employment, full time or part time, was registered. Seven radiographers had less than, and 18 had more than five years of experience. Nine worked full time and 16 part-time. Using logistic regression, the odds for rejecting images

was modeled among radiographers with different experience and employment status.
Results: The crude odds ratio for rejecting images is 1.20 (95% CI: 1.01-1.43) for the full-time employed compared to the part-time employed radiographers, and 0.53 (95% CI: 0.44-0.65) for the experienced radiographers compared to the less experienced ones. Adjusting for these two factors results in a reduced effect of type of employment from 1.20 to 1.05 (95% CI: 0.88-1.25). The effect of experience remains constant when adjusting for type of employment (OR=0.54, 95% CI: 0.44-0.66).
Conclusion: The reject rate was higher among the less experienced radiographers and was not significantly influenced by type of employment.
Author Disclosures:
R. Hammond: Advisory Board; Hologic, Inc. 2012. Other; Travel costs 2012, Hologic, Inc. **K. Pedersen:** Advisory Board; Hologic, Inc. 2012. **R. Gullien:** Other; Travel costs 2012, Hologic, Inc. **P. Skaane:** Equipment Support Recipient; Hologic, Inc. Research/Grant Support; Financial support when overtime reading was necessary by Hologic, Inc.

B-0276 14:54

DICOM metadata-mining in PACS for computed radiography X-Ray exposure analysis: a mammography multisite study
M.R.D. Santos, A. Silva, N. Rocha, P.S. Couto; *Aveiro/PT (mrs@ua.pt)*

Purpose: Extract DICOM Metadata from disperse Picture Archiving and Communication Systems using the Dicoogle (www.dicoogle.com) system for the x-ray exposure variation analysis in Computed Radiography Mammographic studies.
Methods and Materials: DICOM metada stored in several PACS sites were extracted after Dicoogle user validation. Retrieved tag-value data elements were used to objectively assess X-ray exposure. Due to its generalised availability, the DICOM attribute "Sensitivity" was chosen as the main exposure related parameter that was used to instance our approach in a mammographic multi-site study spanning 2008-11 data. The Kruskal-Wallis statistical test was used to characterise exposure variation patterns both for intra-site and inter-site assessments.
Results: With the indexed retrieval process we efficiently assembled 8087 images, from 2047 studies belonging to 1757 patients. The detector x-ray exposure values (S Value) analysis exhibited a reduction of radiation exposure over time in institution B. In institution A a sharp increase was identified during 2009 and 2010 and a decreased during 2011. The variation of the exposure values is statistically significant ($p < 0.001$). High standard deviation values, associated with a high exposure levels, are themselves significant and may result from mammographic studies performed with an x-ray overexposure or underexposure.
Conclusion: The developed exposure assessment methodology shows that the efficient mining of DICOM metadata, stored over disperse PACS archives of radiology departments is possible and, may definitely contribute to quality control initiatives at radiology departments, namely in radiation protection and protocol optimisation scope.

B-0277 15:03

Visibility of cancer mimicking lesions in a polyvinyl alcohol breast phantom using mammographic imaging: relationship between phantom thickness and lesion visibility
M.S. Ossati, K. Szczepura, A.M. Marono, G.G. Wåde, J. Wilkinson, K. Boerma, P. Sanderson, S. Kramer, S.S. Evensen, P. Hogg; *Salford/UK (M.S.Ossati@edu.salford.ac.uk)*

Purpose: To determine the relationship between lesion visibility and phantom breast thickness in mammographic imaging.
Methods and Materials: Two PVAL phantoms, each containing a contrast-enhanced lesion, were evaluated. The mechanical and x-ray attenuation properties of the phantoms/lesions were similar to fatty breast tissue and malignant disease. Images were obtained, under different thicknesses, using FFDM. Lesion visibility was assessed using visual analysis of the sharpness and contrast using a 2 alternative forced choice (2 AFC). The lesion size was measured and the contrast to noise ratio (CNR) was calculated.
Results: All results demonstrated a non-linear relationship between phantom thickness and lesion visibility. The initial thickness was 45 mm. The average 2 AFC score in phantom 1 and phantom 2 ranged from 3.43 to 6.29 and 3.86 to 6.86, respectively, with the highest value at a thickness reduction of 40% in phantom 1 and 62% in phantom 2. The CNR in phantom 1 and phantom 2 ranged from 3.00 to 9.68 and 4.29 to 10.69, respectively, with the highest value at a thickness reduction of 62% in Phantom 1 and 49% in phantom 2. linear relationship was shown between thickness reduction and the area of the lesion.
Conclusion: For the deformable phantom, using 2 AFC, lesion visibility increases as thickness reduces to a certain point, beyond which lesion visibility deteriorates. Further research is necessary to understand why visibility deteriorates.

B-0278 15:12

Radiographers practice concerning breast compression in mammography: gradual versus no gradual
M. Bule, C.S.D. Reis; *Lisbon/PT (claudia.reis@estesl.ipl.pt)*

Purpose: Evaluate the type of breast compression (gradual or no gradual) that provides less discomfort to the patient.
Methods and Materials: The standard projections were simulated [craniocaudal/(CC) and mediolateral-oblique/(MLO)] with the two breast compressions in 90 volunteers women aged between 19 and 86. The women were organised in groups according to the breast density. The intensity of discomfort was evaluated using the scale that have represented several faces (0-10) proposed by Wong Baker in the end of each simulation. It was also applied an interview using focus group to debate the score that were attributed during pain evaluation and to identify the criteria that were considered to do the classification.
Results: The women aged between 19-29y (with higher breast density) classified the pain during no gradual compression as 4 and the gradual compression as 2 for both projections. The MLO projection was considered the most uncomfortable. During the focus group interview applied to this group was highlighted that compression did not promoted pain but discomfort. They considered that the high expectations of pain did not correspond to the discomfort that they felt. Similar results were identified for the older women (30-50y; > 50y).
Conclusion: The radiographers should considerer the technique for breast compression. The gradual compression was considered for the majority of the women as the most comfortable regardless of breast density. The MLO projection was considered as uncomfortable due to the positioning (axila and inclusion of pectoral muscle) and due to the higher breast compression compared to the CC projection.

14:00 - 15:30 **Room P**

Computer Applications

SS 205

Computer applications and dose reduction

Moderators:
F.H. Barneveld Binkhuysen; Soest/NL
M. Müller-Eschner; Heidelberg/DE

B-0279 14:00

Lesion size is a potential confounder for tumour heterogeneity assessed with first order histogram features entropy and uniformity
M. Benndorf, M. Soschynski, S. Bucher, M. Windfuhr-Blum, M. Langer, E. Kotter; *Freiburg/DE (matthias.benndorf@uniklinik-freiburg.de)*

Purpose: To investigate whether tumour heterogeneity measured with first order histogram features depends on lesion size. Measurement of tumour heterogeneity is considered to be an emerging tool for lesion stratification according to histopathological type and survival prognosis.
Methods and Materials: 68 consecutive breast MRI mass lesions (24 benign, 44 malignant) were retrospectively analysed. Tumours were manually segmented in early contrast enhanced subtraction images that showed the largest axial tumour diameter. For each tumour, mean, standard deviation, skewness, kurtosis, empirical Shannon entropy [-1*Σp (a)*log (p (a))] and uniformity [Σp (a)^2] were calculated.
Results: Malignant lesions showed higher entropy values (mean: 4.671) and smaller uniformity values (mean: 0.012) than benign lesions (mean: 4.098 and 0.019, respectively, $P < 0.01$ each). Mean signal intensity was significantly higher in malignant lesions, no difference was observed for standard deviation, skewness and kurtosis of the tumours' signal intensity histograms. Receiver-Operating-Characteristic (ROC) analysis yielded an AUC for entropy as diagnostic variable of 0.792. However, benign lesions were in average smaller than malignant lesions ($P < 0.01$, 9 mm versus 17 mm). Lesion size measured in voxels per tumour yielded an AUC of 0.790 if used as diagnostic variable. The DeLong method showed no significant difference of the ROC curves (P=0.94). There was a strong correlation between entropy and lesion size (Spearman correlation coefficient: 0.92).
Conclusion: Lesion size, since correlated with the independent variable entropy and the outcome variable, is identified as a potential confounder for studies that derive diagnostic thresholds for entropy and uniformity as measures for tumour heterogeneity.

B-0280 14:09

Vessel probe reconstructions and 3D analysis software in the CT characterisation of incidentally detected breast lesions

M. Moschetta, M. Telegrafo, A. Scardapane, V. Lorusso, L. Rella, G. Angelelli, A. Stabile Ianora; *Bari/IT (marco.moschetta@gmail.com)*

Purpose: To evaluate the potential benefits of 320-row MDCT in the evaluation and differential diagnosis of incidentally detected breast lesions by using Vessel probe in MPR mode reconstructions and 3D analysis software with net enhancement value.
Methods and Materials: 62 breast lesions in 46 patients who underwent 320-row chest CT examination because of different clinical issues were retrospectively evaluated. CT scans were assessed searching for presence, location, number, morphological features and density of breast nodules. NET enhancement was calculated by subtracting pre-contrast density from the density obtained by post-contrast values. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and diagnostic accuracy of CT were calculated firstly for morphological features and then for dynamic behaviour.
Results: 30/62 lesions were found to be malignant at histological examination. 32 nodules were found to be benign at histological examination. By considering morphological features, sensitivity, specificity, accuracy, positive predictive and negative predictive values were 87%, 100%, 88%, 100% and 50%, respectively, for CT. Basing on NET enhancement, CT obtained sensitivity, specificity, accuracy, positive predictive and negative predictive values of 100%, 94%, 97%, 94% and 100%, respectively.
Conclusion: MDCT allows to recognise breast lesions and to suggest a differential diagnosis of benign from malignant lesions basing on morphological and dynamic features. Net enhancement can also be proposed as an additional accurate CT feature.

B-0281 14:18

The impact of a novel iterative model-based reconstruction algorithm on prosthetic heart valve related artifacts at reduced radiation dose multidetector-row CT

D. Suchá[1], M.J. Willemink[1], P.A. de Jong[1], A.M.R. Schilham[1], T. Leiner[1], P. Symersky[2], R.P.J. Budde[1]; [1]*Utrecht/NL*, [2]*Amsterdam/NL (D.sucha@umcutrecht.nl)*

Purpose: Prosthetic heart-valve (PHV) assessment with computed tomography (CT) is thriving, but remains hampered by PHV-related artefacts and high radiation-dose. The impact of a hybrid and prototype model-based iterative-reconstruction method and dose reduction on PHV-related artefacts and image quality (IQ) were assessed.
Methods and Materials: One transcatheter (Edwards-Sapien) and two mechanical (St. Jude, Medtronic-Hall) PHVs were embedded in diluted contrast and imaged with retrospectively-ECG-gated CT. Eight scans were acquired of each PHV at 120 kV, 600 mAs (routine) and 150 mAs (reduced-dose). Data were reconstructed with filtered back-projection (FBP), hybrid iterative-reconstruction (IR, iDose4) and model-based iterative-reconstruction (IMR, Philips-Healthcare). Hypodense and hyperdense artefact-volumes were measured by two threshold-filters. Signal-to-noise (SNR) and contrast-to-noise (CNR) ratios were calculated. Statistical analysis was done with the Friedman-test (significance: $P < 0.05$).
Results: Artefact-volumes differed significantly between reconstruction algorithms for all PHVs and scans ($P < 0.004$). Compared to FBP, overall hypodense and hyperdense artefact-volumes decreased by 4% and 1% (IR) and 1% and 4% (IMR) at 600 mAs; and 53% and 20% (IR) and 67% and 23% (IMR), respectively, at 150 mAs. Iterative-reconstruction increased SNR and CNR at all doses ($P < 0.001$). At 150 mAs median SNR and CNR increased from 5 and 5 (FBP) to 7 and 7 (IR) and 33 and 38 (IMR), respectively ($P < 0.001$). Even at reduced dose, IMR resulted in higher IQ than routine dose FBP and IR.
Conclusion: Iterative-reconstruction significantly reduced PHV-related artifacts and improved IQ. With 75% reduced-dose IMR IQ was higher than with routine dose FBP and IR. Thus, IMR allows for more radiation dose reduction than IR while maintaining high IQ.
Author Disclosures:
R.P.J. Budde: Research/Grant Support; This study was supported by a grant of The Dutch Heart Foundation [2009B014]. The department of Radiology, University Medical Center Utrecht received Research Support from Philips Healthcare.

B-0282 14:27

Influence of 4th generation iterative reconstruction system on image quality in computed tomography in adults with acute appendicitis

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Purpose: To define image quality of an iterative reconstruction (IR) system in low-dose abdominal computed tomography (CT) in patients with histopathologically proven appendicitis in an intraindividual comparison to filtered back projection (FBP) and to evaluate dose reduction capability.
Methods and Materials: 12 patients (mean BMI 23.6 kg/m^2) with appendicitis underwent a preoperative reduced-dose 256-CT (RDCT) scan (Brilliance iCT; 80 eff. mAs; mean $CTDI_{vol}$: 8.9 mGy). The raw data were reconstructed using FBP and IR system (iDose4™, Philips, Best, the Netherlands) with two iteration levels (4: 50% iteration; 6: 70% iteration). 12 other patients (mean BMI 24.1 kg/m^2) with appendicitis who had undergone standard-dose CT (SDCT) with FBP reconstructed images (mean exposure 140 mAs; mean $CTDI_{vol}$: 632.8 ± 509.8 mGy; range 415-1193 mGy) served as reference standard. Two blinded radiologists rated subjective image quality and signs of appendicitis on CT. Additionally, the objective image noise (OIN) was assessed.
Results: In RDCT iDose level 6 leads to a decrease in OIN (FBP vs. iDose: psoas major muscle 64.4 vs. 49.3 HU), providing also significant improvements in image quality and noise reduction compared to RDCT FBP images. The detection of appendicitis signs e.g. periappendiceal fat attenuation was limited in RDCT FBP images. RDCT with iDose4™ level 6 was determined to be of equivalent image quality as SDCT with FBP.
Conclusion: These pilot data propose that iDose4™ has potential to remarkably improve image quality in reduced-dose abdominal CT in the diagnosis of appendicitis while simultaneously reducing image noise.

B-0283 14:36

Evaluation of the effectiveness of rigid and deformable motion-correction algorithms with regard to CT-perfusion measurements in abdominal organs affected by breathing motion

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Purpose: To evaluate the effectiveness of different motion-correction algorithms and their effect on CT-perfusion map calculation in abdominal organs affected by breathing motion.
Methods and Materials: CT-perfusion sequences were dynamically acquired over 51s (34 acquisitions every 1.5s) in five patients with recurrent pancreatic carcinoma. Image data were motion-corrected throughout the dynamic acquisition using commercially available CT-perfusion software (BodyPCT, Siemens Healthcare, Forchheim, Germany) or custom-developed deformable registration (demons algorithm). After motion-correction, perfusion maps were calculated using a combined Maximum-Slope/Patlak-model (BodyPCT); R^2-value and residual of the perfusion model fit were determined. Two blinded experienced radiologists rated motion-correction quality in terms of "in-plane" and "out-of-plane" correction and "overall quality", and resulting perfusion maps in terms of "vessel correction", "validity of perfusion values", and "overall quality" on a five-point scale (1=worst, 5=best).
Results: Deformable registration scored higher (rating-criteria averaged mean score 3.8) than BodyPCT (3.0) and a control group without motion-correction (3.1; all $p < 0.0001$) in all motion-correction categories. BodyPCT and control group did not differ significantly ($p >= 0.09$). Perfusion maps were not affected by choice of motion-correction method ($p >= 0.09$); average mean scores were 3.5 (deformable), 3.1 (BodyPCT), 3.0 (control). Average R^2 of deformably registered images was higher (0.76/0.51/0.66) and residual lower (0.033/0.079/0.044) than for rigid (BodyPCT) or without registration.
Conclusion: Deformable registration for motion-correction in abdominal organs improves spatial alignment of the target region throughout the time course of dynamic CT sequences, resulting in increased accuracy of perfusion model fits. However, larger sample sizes are necessary for quantification of motion-correction effects on perfusion maps.

B-0284 14:45

Denoising of HRpQCT scans via dicitionary learning for improved spatio-temporal morphometry analysis

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Purpose: High-resolution quantitative CT (HRpQCT) images have shown promise in studying in-vivo bone microarchitecture at the ultradistal extremities. HRpQCT produces isotropic volumetric images at a resolution of 82 µm. Standard scans cover 9 mm of the distal radius or tibia and last 3 minutes with a radiation dose < 3 µSv. Spatio-temporal morphometry (S^{TM}) of longitudinal HRpQCT scans involves rigid registration of baseline and follow-up scans, segmentation of mineralised bone regions, and estimation of the magnitude and directionality of local microarchitectural changes. However, noise in HRpQCT images contributes errors at each step.
Methods and Materials: We propose a 3D dictionary learning (DL) approach to HRpQCT image denoising to improve S^{TM}. DL enables sparse approximation of image data through linear combinations of representative image patches (the dictionary) in a two-step optimisation process. Radius HRpQCT scans were acquired from a set of 23 cadaver arms. Parameters for 3D DL included patch shape (cubic or spherical), patch size (3 to 7 voxels), dictionary size (128 to 640 elements), and the optimisation technique.
Results: Peak signal-to-noise ratio (PSNR) between the original and denoised images was used to compare results. Patch size was found to be the most relevant variable, with smaller patches leading to higher PSNR for both cubic and spherical patches. PSNR, measured as decibels (dB), was seen with cubic patches of size 3 (33.4±1.19) and spherical patches of diameter 5 (32.5±1.12).
Conclusion: We have assessed 3D dictionary learning as a method for minimising noise while preserving fine structures in HRpQCT images.

B-0285 14:54

UNSCEAR survey system: a software platform to support the global survey of medical radiation usage and exposures

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Purpose: The United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) established by the United Nations General Assembly in 1955 to assess and report levels and effects of all sources of ionizing radiation conducts regular surveys on medical radiation exposure. A new web-based platform with adequate software tools to support UNSCEAR's survey was developed and will be presented.
Methods and Materials: The software platform is composed of a web portal accessible at http://survey.unscear.org that serves as a interface to participating countries. National contact persons (NCP) need to register themselves on the platform to be able to access it. After validation, the NCP will have access to the countries private area, where they find specific templates for Diagnostic Radiology, Interventional Radiology, Nuclear Medicine and Radiotherapy. Only NCP are eligible to submit official countries data, which will then undergo another validation step by scientific experts. The national data will then inserted in the last component of the system, the UNSCEAR Database for further processing and analysis.
Results: The UNSCEAR Survey System is composed of three major components: the user portal that manages the collected data and the participants, the dedicated spreadsheets that are used to provide the national data and the UNSCEAR Database that store the data and the results of the evaluation.
Conclusion: The new UNSCEAR Survey System will facilitate the data collection and management process that will have a positive impact on the outcomes of UNSCEAR's next Global Survey of Medical Radiation Usage and Exposures.

B-0286 15:03

Assessment of the diagnostic value of virtual mono-energetic images generated by a novel spectral-detector CT (SDCT) prototype

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Purpose: To compare diagnostic value of virtual mono-energetic 120 kVp images with "conventional" abdominal CT images, generated by a single spectral-detector CT (SDCT) acquisition.
Methods and Materials: Following IRB approval and informed consent, abdominal CT images of 30 patients (mean age 59) were acquired with a novel SDCT prototype (Philips Healthcare, Cleveland, OH). The SDCT acquisition parameters were 120 kVp and 59-259 mAs. For each SDCT study, "conventional" CT images, comparable to those obtained by a standard MSCT system, are generated along with virtual mono-energetic images in the range 40 keV to 140 keV. Two qualified radiologists assessed the overall diagnostic value of mono-energetic images at 65 keV, compared to "conventional" SDCT images using a scale of 1 to 4. Scores 3-4 indicated the mono-energetic image showing reduced image artifacts and/or enhanced image contrast. The one sample proportion test was applied.
Results: All reconstructed mono-energetic SDCT images at 65 keV were diagnostic. Compared to conventional SDCT images, the mono-energetic images were ranked as markedly better for 25 patients (83.3%), better for 3 (10%), and equivalent for 2 (6.7%), with a confidence level of 95%. Differences between mean HU values for ROIs of the 65 keV virtual mono-energetic images and conventional SDCT images at 120 kVp were 5.3±1.3 HU in the aorta, 21±3.0 HU in cortical bone, 6.2±1.2 HU in the liver and 6.0±2.2 HU in fat ($p > 0.1$).
Conclusion: Mono-energy images in most cases demonstrated improved image quality with enhanced image contrast and artefact suppression compared to conventional-SDCT abdominal images.
Author Disclosures:
Z. Romman: Employee; Philips. **J. Sosna:** Consultant; Actiview.

B-0287 15:12

Accuracy of coronary plaque detection using a semiautomatic plaque analysis software in computed tomography coronary angiography

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Purpose: To assess the accuracy of coronary plaque detection with a semiautomatic plaque analysis software in computed tomography coronary angiography (CTCA) with a 256-MSCT scanner.
Methods and Materials: Ten patients undergoing prospectively ECG-triggered, axial CTCA on a 256-MSCT scanner (Brilliance iCT; tube voltage,120 kVp; tube current-time product, 250 mAs; collimation, 2 x 128 x 0.625 mm, reconstructed slice thickness, 0.9 mm) were enclosed in this study. All plaques were evaluated with a dedicated semiautomatic plaque analysis software "Comprehensive Cardiac Analysis" (Extended Brilliance Workspace, Philips Healthcare, Best, The Netherlands). After semiautomatic coronary artery extraction automatically detected lesions are marked by the software as plaques. The observers evaluated, if these automatically marked lesions corresponded with visually detectable plaques. Potential reasons for a false-positive plaque detection were analysed.
Results: The software automatically identified 114 structures as plaques. 32 (28%) of the automatically marked lesions complied with plaques (true-positive). 82 (72%) of the lesions did not correspond with visually detectable plaques (false-positive). 20 plaques were manually detected by observers but not by the software (false-negative). For 82 false-positive detected plaques, the following potential reasons were noticed by the observers: high density in pericoronary fat (59%), vessel ramification (24%), contrast in adjacent veins (6%), artery kinking (4%) and falsely contoured vessel (7%).

Conclusion: The evaluated semiautomatic plaque analysis software demonstrates a very high false-positive detection rate of coronary plaques. A revision of the software marked lesions as plaques is indispensable.

B-0288 15:21

Coronary CT angiography using 2° generation iterative reconstruction vs filtered back projection: evaluation of image quality and radiation dose saving potential. A validation study

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Purpose: To compare IQ of iterative reconstruction (SAFIRE) settings vs. filtered back projection (FBP) in CT Coronary Angiography (CTCA).
Methods and Materials: Twenty consecutive patients underwent CTCA for suspected or known Coronary Artery Disease (CAD) with Dual-Source CT (CT Flash, Siemens). Datasets were reconstructed using two standard FBP (B26-B46) kernels and three comparable SAFIRE settings (S2, S3, S4). Vascular attenuation and noise were measured. CT vascular attenuation values were measured in: ascending aorta (Ao), right (RCA) and left (IVA) coronary artery, respectively. Results were compared with ANOVA and Pearson's r correlation coefficient. S/N and C/N were calculated. A p-value of 0.05 was considered significant.
Results: We didn't find significant differences between attenuation values of FBP and SAFIRE, except for the noise ($p < 0.05$). Infact, noise was 15, 12, 10, 9 HU in B26, S26-2,-3 and -4, respectively, and was 27, 20, 17, 16 HU in B46, S46-2,-3 and -4, respectively. Comparing FBP with corresponding SAFIRE's setting, ANOVA test showed significant differences in both RCA and IVA (B26 vs. S46-2,-3,-4, and B46 vs. S26-2,-3,-4). Lowest noise was found for SAFIRE using S26-4 (9.6 HU) and I46-4 (15.6 HU). SAFIRE can provide S/N and C/N significantly higher with increasing kernel sharpness. Moreover, the best S/N and C/N was found for S26-3 and S46-4.
Conclusion: In CTCA, SAFIRE settings at medium (S3 in B26) and slowly high strength (S4 in B46) can be used in clinical routines and may have more potential than FBP for CAD evaluation improving diagnostic accuracy and/or holding the potential for radiation dose reduction.

Friday, March 7

10:30 - 12:00 **Room C**

Cardiac

SS 503

Cardiac imaging: new horizons

Moderators:
T.R.C. Johnson; Munich/DE
J.-F. Paul; Le Plessis Robinson/FR

B-0289 10:30

Integrated and quantitative comparison of PET and MRI in acute myocardial infarction

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Purpose: To quantitatively compare positron emission tomography (PET) and late gadolinium-enhancement (LGE) in the assessment of acute myocardial infarction.
Methods and Materials: Simultaneous cardiac PET/MRI (Biograph mMR, Siemens Healthcare) with 18 F-fluorodeoxyglucose (18 F-FDG) was performed in 25 patients with an acute occlusion of a coronary artery and interventional recanalisation. Cine, T2-weighted and LGE images were acquired in parallel to an ECG-gated PET scan. Infarcts were categorised into 1-25%, 26-50%, 51-75% and 76-100% transmurality in LGE images. Short-axis LGE and PET images were processed and transformed into co-registered polar (bull's eye) plots using dedicated software developed in-house. Segment wise (90 segments/slice; 630-990 segments/scan) inter-method correlation was calculated with weighted Pearson's product-moment correlation coefficients. Binary inter-method agreement in infarct delineation was calculated as Cohen's kappa.
Results: Median correlation coefficient was -0.16±0.21, -0.48±0.14, -0.73±0.08 and -0.79±0.10 for 1-25%, 26-50%, 51-75% and 76-100% transmurality, respectively. Median kappa was 0.04±0.19, 0.34±0.19, 0.77±0.16 and 0.81±0.14 for 1-25%, 26-50%, 51-75% and 76-100% transmurality, respectively. Mean infarct size in LGE images was 32.2±14.3 ml and 41.7±31.1 ml in PET images. In 11 patients with visually conclusive agreement between PET and LGE, the defect was significantly (p=0.03) larger in PET images. In 6 patients no LGE but a clearly reduced 18 F-FDG uptake was found in the perfusion territory of the occluded coronary artery.
Conclusion: Concordance between PET and LGE was dependent on infarct transmurality and therefore associated with high agreement in transmural and relatively poor agreement in subendocardial infarcts. However, reduced 18 F-FDG uptake seemed to correspond with the area-at-risk.

B-0290 10:39

Comparison of cardiac function in synchronously acquired Hybrid PET-MRI data

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Purpose: To determine and compare the cardiac function in synchronously acquired Hybrid PET-MRI data sets.
Methods and Materials: In 10 patients (8 male, 2 female, mean age 48 ± 18 years), who underwent a [18 F]-FDG-PET-CT due to a non-cardiac indication and showed a homogenous cardiac FDG uptake, a synchronous PET-MRI (Biograph mMR, Siemens, Erlangen, Germany) was performed with the residual activity of the previous investigation. The PET acquisition time was 15 min, while simultaneously standard cine sequences were acquired in short axis, two- and four-chamber orientation. PET and MRI data were evaluated by two investigators blinded to the results of the other method. The left ventricular end-diastolic volume (EDV) and end-systolic volume (ESV), ejection fraction (EF) and left ventricular myocardial mass (MM) were measured and mean differences (MD) were calculated. Pearson correlation coefficients (r) were determined and a Bland-Altman analysis was conducted.
Results: The comparison showed a good correlation of cardiac function parameters (EDV: r = 0.94; ESV: r=0.88, MM: r=0.71, EF: r=0.72). The MD of EDV was 5±8 ml in favor of the PET, (p=0.67), ESV was measured the same size (MD 0 ± 7 ml, p=0.99). EF showed with a MD of 1 ± 7%, no significant difference between the two methods (p=0.78). The MM was measured 19 ± 15 g ($p < 0.05$) greater with PET than with MRI.
Conclusion: In simultaneously acquired cardiac PET/MR data EDV, ESV and EF show a very good agreement. Only the left ventricular wall mass shows a statistically significant difference in favor of the PET.

B-0291 10:48

Validation of coronary CT angiography-derived fractional flow reserve with catheter-based fractional flow reserve

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Purpose: Catheter-based fractional flow reserve (FFRCath) has become the reference standard to determine the functional severity of angiographic coronary artery disease (CAD). The feasibility of non-invasive estimations of functional severity from anatomical coronary CT angiography (CCTA) images using computational fluid dynamics has recently been reported. In this study, we investigate the performance of CCTA-derived fractional flow reserve calculation (FFRCT) compared with FFRCath and determine the incremental diagnostic value of FFRCT over CCTA.
Methods and Materials: We evaluated the diagnostic performance of a novel FFRCT algorithm (Siemens Medical Solutions, Forchheim, Germany) that can be performed on-site without transfer of data. Based on the left ventricular mass, coronary anatomy derived from CCTA and several hemodynamic parameters, FFRCT can be computed. In this study, we included 101 patients who underwent a CCTA followed by a FFRcath within 50 days. FFRCT and FFRcath results are compared using Spearman's coefficient and Bland-Altman analysis. In addition, the incremental value of FFRCT over CCTA will be determined using C-statistics.
Results: Baseline characteristics: mean age 62 years, 79% male, 17% with history of diabetes and average calcium score 744. In these 101 patients, 181 vessels were interrogated with an FFR catheter, of which 77 vessels were considered haemodynamically obstructed (FFRCath ≤ 0.80). We preformed CCTA-derived coronary artery lumen segmentations in all 101 patients. At the time of abstract submission, FFRCT analysis with the latest iteration of the work-in-progress software was ongoing.
Conclusion: We will report the diagnostic performance of a new algorithm for CCTA-based FFRCT.
Author Disclosures:
K. Nieman: Research/Grant Support; Grant from Siemens Medical Solution, for a previous unrelated study.

B-0292 10:57

A virtual two-dimensional cardiac phantom for calculation of regional left ventricular strain using non-rigid image registration

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Purpose: To evaluate a non-rigid image registration algorithm for left ventricular (LV) strain measurements on a virtual LV phantom and to establish a method to compute circumferential and radial strain using cine-gated, non-tagged MR images.
Methods and Materials: A two-dimensional virtual LV phantom was developed, recreating a series of twenty-nine circular masks simulating the midventricular plane of short-axis cine MR images of the left ventricle. Non-rigid image registration was performed, using the resulting deformation field for quantification of circumferential and radial strains ("virtual tagging"). The virtual LV phantom was further divided in four segments. Statistical analysis was done using Pearson correlation coefficient calculations.
Results: Strain values from virtual tagging were highly correlated with the real values. Overall peak circumferential strain determined by virtual tagging differed 1.6% from real values (r^2 = 0.97; P < 0.0001). Overall peak radial strain determined by virtual tagging differed 0.8% from real values (r^2 = 0.98; P < 0.0001). When dividing the phantom into four segments, circumferential strain determined by virtual tagging differed 4.4 - 6.3% from real values (r^2 = 0.95; P < 0.0001) and radial strain differed 1.2 - 2.9 % from real values (r^2 = 0.95; P < 0.0001).
Conclusion: Circumferential and radial strain values computed from non-rigid registration followed by analysis of the resulting deformation field (virtual tagging) correlate significantly with real values of a virtual LV phantom, making it a promising tool to compute strains using cine-gated, non-tagged MR images.

B-0293 11:06

Evaluation of epicardial adipose tissue using CT angiography: evaluation of a prototype software

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Purpose: This study evaluated the performance of a novel automated software tool for epicardial fat volume (EFV) quantification compared to a standard manual technique at coronary CT angiography (cCTA).

Methods and Materials: cCTA data sets of 70 patients (58.6±12.9years, 33 men) were retrospectively analysed using two different post-processing software applications. Observer 1 performed a manual single-plane pericardial border definition and EFVM segmentation (manual approach). Two observers used a software program with fully-automated 3D pericardial border definition and EFVA calculation (automated approach). EFV and time required for measuring EFV (including software processing time and manual optimisation time) for each method were recorded. Intra-observer and inter-observer reliability was assessed on the prototype software measurements. T test, Spearman's rho, and Bland Altman plots were used for statistical analysis.
Results: The final EFVA (with manual border optimisation) was strongly correlated with the manual axial segmentation measurement (60.9±33.2 mL vs.65.8±37.0 mL, rho=0.970, $P < 0.001$). A mean of 3.9±1.9 manual border edits were performed to optimise the automated process. The software prototype required significantly less time to perform the measurements (135.6±24.6s vs. 314.3±76.3s, P0.9).
Conclusion: Automated EFVA quantification is an accurate and time saving method for quantification of EFV compared to established manual axial segmentation methods
Author Disclosures:
U.J. Schoepf: Grant Recipient; Bayer, Bracco, GE, Medrad, Siemens. **C. Canstein:** Employee; Siemens.

B-0294 11:15

Feasibility study of free-breathing diffusion tensor imaging in porcine acute myocardial infarction model

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Purpose: To evaluate the feasibility of in vivo DT-MRI without breath-hold with regard to changes in direction-dependent water diffusivity reflecting alterations in tissue integrity such as apparent diffusion coefficients (ADC), fractional anisotropy (FA), and fiber length.
Methods and Materials: Acute myocardial infarction (AMI) was induced by ligation of mid segment of left anterior descending coronary artery (LAD) in sixteen pigs. DT-MRI using a SENSE-based echo-planar imaging technique was acquired using a 1.5-tesla MR scanner with free-breathing state using navigator sequence. With a b-value of 300 s/mm^2, the diffusion tensor images were obtained for 6 diffusion-sensitizing gradient directions at infarcted zone at the mid-ventricular level. Image quality of the acquired DTI was evaluated. The ADC, FA, and the fiber length were measured for quantitative analysis.
Results: Image quality was good in 3 pigs, fair in 2 pigs, and poor in 2 pigs.The infarct zone showed significantly increased ADC than that of the remote zone ($8.097 \pm 3.741 \times 10^{-3}$ mm^2/sec versus $5.894 \pm 2.985 \times 10^{-3}$ mm^2/sec, P=0.018). The FA of the infract zone was seen to be also significantly lower than that of remote zone (0.393 ± 0.972 versus 0.485 ± 0.145, P=0.018). The fiber length in the infarct zone was seen to be significantly shorter than the remote zone (17.57 ± 5.46 mm versus 24.84 ± 9.79 mm, P=0.018).
Conclusion: In vivo DT-MRI's of post-infarct myocardium with fair or good image quality can be acquired and the results correlated well with those of ex-vivo and breath-hold studies.

B-0295 11:24

New micro angiographic system for evaluation therapeutic effects of C-kit positive cardiac stem cells

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Purpose: Recently, the number of heart failure by ischaemic disease is increasing. Tissue engineering is hopeful, however, the evaluating tools are not sufficient. We developed microangiographic system, and assessed therapeutic effects.
Methods and Materials: The system we developed has a cerium anode which has characteristic X-ray around 34.6 Kev. It is close to K-edge of contrast materials (Iodine and Barium), therefore, the system can detect tiny amount of iodine. C-kit positive cardiac stem cells (CSCs) were isolated and cultivated by left auricles of dogs. Acute myocardial infarction (AMI) was made at the apex, and the cultured autologous CSCs were injected directly to the cardiac wall of the ischaemic area in 5 dogs (CSCs group). One month later, the hearts were excised and the coronary artery was full-filled with barium. Then, they were radiated by the system. In other five dogs, the cardiac wall of the ischaemic area was injected with saline (saline group).
Results: We lost 2 dogs in CSCs group and 3 dogs in saline group due to lethal arrhythmia. In CSCs group, a lot of newly formed vessels were visualised at the apex. They were meandering with irregularities. The minimum diameter of vessels was 50 µm. The new vessels were visualised in all dogs in CSCs group. Besides, avascular area was visualised at the apex without new vessels in saline group.
Conclusion: The therapeutic effects of CSCs for ischaemic disease were evaluated by visualising newly formed vessels. Our microangiographic system is useful for the evaluation.

B-0296 11:33

Feasibility of an ultra-low dose CT for left atrium and pulmonary veins imaging using VEO (model-based iterative reconstruction)

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Purpose: To evaluate the feasibility of ultra-low dose CT for left atrium and pulmonary veins imaging using VEO (model-based iterative reconstruction).
Methods and Materials: 120 patients with persistent or intermittent atrial fibrillation before catheter ablation were enrolled in our study. Patients were randomised into 2 groups: Group 1 (60 pts, MDCT with VEO, no ECG triggering, 100 kV and 60 mA, irrespective of patient BMI) and Group 2 (60 pts, MDCT with standard acquisition, ECG triggering, ASIR, kV and mA tailored on patient BMI). The image quality (graded as good, adequate and poor) was evaluated by two reviewers. The CT-attenuation, image noise, signal-to-noise ratio (SNR), contrast-to-noise ratio (CNR) of left atrium and every pulmonary vein branch and Effective Dose (ED) were evaluated and compared between two groups.
Results: No differences were found between two groups in terms of gender and BMI and image quality score. No significant differences were found in CT-attenuation of left atrium and pulmonary veins between two groups but statistically significant differences were found between Group 1 and Group 2 in SNR, CNR and noise of left atrium (26.2±7.6 versus 14.1±4.4, $p < 0.00001$ and 23.06±7.09 versus 12.06±3.8, $p < 0.00001$, respectively) and of pulmonary veins. Group 1 patients showed a significantly lower mean ED in comparison with Group 2 (0.5±0.05 versus 5.07±3.3 mSv).
Conclusion: The CT for left atrium and pulmonary veins imaging using VEO is feasible and allows to perform the examination with very low radiation exposure and good image quality.

B-0297 11:42

Magnetic resonance imaging at 1.5 Tesla in patients with a subcutaneous implantable cardioverter-defibrillator (S-ICD)

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Purpose: The aim of our study was to evaluate the safety of imaging in patients with a new type of implantable cardioverter-defibrillator called the S-ICD in a 1.5 T MRI scanner. With the increasing number of patients with cardiac implantable devices who are indicated for MRI, there is a growing need for establishing MRI compatibility of cardiac implantable devices. We present the first cohort of patients implanted with an S-ICD and safely scanned with a 1.5 T MRI.
Methods and Materials: Patients with implanted S-ICD systems underwent MRI scan of one or more anatomical area. The S-ICD were programmed off and patients were monitored by ECG throughout the imaging procedure. Device function was evaluated pre and post-scan. A thermistor probe was used to monitor temperature changes in the area above the subcutaneous pocket with SICD and patients were asked to report immediately any pain, torqueing movement or heating sensation in the area of either the pocket or electrode.
Results: Thirteen patients underwent a total of 17 examinations at 1.5 T. Scans included brain, spine and cardiac imaging. Two patients were re-scanned due complaints of heating over the pocket during lumbar scans, caused by a thermistor probe placed on the skin to measure skin temperature. Rescan without the probe and all the remaining scans were performed without incident. No evidence of device malfunction was obversed.
Conclusion: MRI of patients with the implanted S-ICD can be performed safely under controlled conditions. This study was supported by Research Project Charles University in Prague, PRVOUK P34.

B-0298 11:51

Noninvasive measurement of coronary flow velocity reserve by phase-contrast cine MRI at 3 T in the detection of stenosis in the major three coronary arteries

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Purpose: Coronary flow velocity reserve (CFVR) can be noninvasively measured by phase-contrast cine MRI (PC-MRI). To date, CFVR measurement has been studied with 1.5 T system and mainly limited to LAD artery. With 3 T system, however, PC-MRI may allow reliable flow quantification not only in LAD artery but also in RCA and LCX artery due to improved spatial and temporal resolution. The purpose of this study was to evaluate the feasibility of 3 T MR measurement of CFVR for detecting significant stenosis in three major coronary arteries.
Methods and Materials: Sixteen patients (71±9 years) with suspected moderate coronary stenosis on CT angiography were included. CFVR was measured perpendicular to the coronary arteries (total 26 vessels [RCA, 11; LAD, 10; LCX, 5]) using breath-hold PC-MRI at rest and during adenosine triphosphate (ATP)-induced hyperemia with 3 T MR system (Ingenia 3 T, Philips) by two observers. Measurements were compared with quantitative coronary angiography (QCA).
Results: CFVR was successfully determined in 25/26 (96%) vessels. Moderate inverse correlation was found between CFVR and coronary stenosis on QCA (r=-0.57, p=0.002). Using a threshold of 1.5 for CFVR, the sensitivity, specificity, and positive and negative predictive value for detecting ≥50% stenosis on QCA was 83%(5/6), 85%(17/20), 63%(5/8), 94%(17/18), respectively. Intra-class correlation coefficient between CFVR measurements by two observers was 0.82, showing a good inter-observer reproducibility.
Conclusion: CFVR can be determined in three major coronary arteries with a high success rate by using breath-hold PC-MRI at 3 T, and has a great potential for noninvasive assessment of physiologic significance of coronary arterial stenosis.

10:30 - 12:00 **Room D**

Chest

SS 504

Vascular imaging and thromboembolic disease

Moderators:
B. Feragalli; Chieti/IT
T. Frauenfelder; Zurich/CH

B-0299 10:30

Ultra-low dose CT pulmonary angiography reconstructed with a model-based iterative reconstruction: comparison with standard CT pulmonary angiography. A prospective non-inferiority trial

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Purpose: To compare quantitative and qualitative image quality and radiation dose between CT pulmonary angiography (CTPA) reconstructed with filtered back projection (FBP) and ultra-low dose CTPA reconstructed with model-based iterative reconstruction (MBIR).
Methods and Materials: This prospective study was approved by the institutional review board and each patients provided written informed consent. Eighty-two patients were scanned with an ultra-low dose CTPA (100 kV, 20 mA) and eighty-two patients were scanned with a classical CTPA (100 kV, 250 mA). Region of interests were drawn in nine pulmonary vessels; signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) were calculated. A five-point scale was used to subjectively evaluate the quality of CTPA and ultra-low dose CTPA.
Results: Compared to standard CTPA, ultra-low dose CTPA (reconstructed with MBIR) showed no differences in density measured in 9 pulmonary vessels, higher SNR ($p < 0.0001$) and higher CNR ($p < 0.0001$) despite a dose reduction of 93 % ($p < 0.0001$).
Conclusion: Ultra-low dose CTPA reconstructed with MBIR allows a significant dose reduction while improving SNR and CNR in the pulmonary vessels, as compared with classical CTPA reconstructed with FBP.

B-0300 10:39

Iterative reconstruction in single source dual-energy CT pulmonary angiography: Is sufficient to achieve a radiation dose as low as state-of-the-art single-energy CTPA?

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Purpose: Single-source dual-energy CT pulmonary angiography (DE-CTPA) induces an increase of radiation dose going up to 40% when compared to a single-energy examination. Our goal was to cancel this increase by using iterative reconstruction (ASIR).
Methods and Materials: Fifty patients (60% men, 65.8 yo ±15.4, BMI=25.9±4.6) were prospectively included and underwent single-source DE-CTPA with following acquisition parameters: 80/140 kV, 0.6 s rotation time, 275 mA fixed tube current, 50% ASIR. Parameters were tweaked to target a radiation dose similar to a 100 kV single-energy CTPA (DLP of 250 mGy.cm). Thirty patients (46% men, 64.4 yo ±18.6, BMI=26±4.6) from a previous prospective study on DE-CTPA (375 mA fixed tube current, no ASIR) were used as the reference group. Subjective image quality was scored by two radiologists using a 5-level scale. Measures of signal intensity and noise on 65 keV monochromatic reconstructions were used to calculate signal-to-noise (SNR) and contrast-to-noise (CNR) ratios.
Results: All examinations were of diagnostic quality (score ≥3). Compared with the reference DE-CTPA protocol, ASIR effectively achieved a spectacular dose reduction (DLP of 243 mGy.cm VS 388, $p < 0.01$), with a preserved image quality (4.4/5 VS 4.6, p=0.23) and an equivalent SNR (16.4 VS 14.9, p=0.27) and CNR (14.1 VS 12.7, p=0.28). SNR, CNR and image quality were negatively correlated with Body Mass Index, which could therefore be used to adjust radiation dose to the patient's morphology.
Conclusion: Thanks to iterative reconstruction, single-source DE-CTPA can be achieved at diagnostic quality with a radiation dose no greater than a single-energy examination (DLP of 243 mGy.cm).

B-0301 10:48

Combined MR imaging of acute pulmonary embolism and deep vein thrombosis: diagnostic accuracy of unenhanced balanced steady-state free precession and contrast-enhanced 3D gradient echo sequences

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Purpose: To evaluate diagnostic performance of combined MR imaging in pulmonary embolism (PE) and deep vein thrombosis (DVT).
Methods and Materials: Combined pulmonary and lower extremity MR imaging and Doppler sonography were performed in 29 patients (18 men, 11 women) within 72 hours after computed tomography angiography (CTA). MR technique included two sequences: unenhanced balanced steady-state free precession (SSFP), and contrast-enhanced three-dimensional (3D) gradient-echo (GRE). Two reviewers analysed CT angiography and each MR sequence and recorded the presence of emboli in pulmonary arteries and thrombi in lower extremity veins. Diagnostic accuracy of each MR technique was calculated using CTA (in chest) and sonography (in lower extremities) as the reference standard.
Results: A total of 210 emboli were detected in 18 (62%) patients on CTA. DVT was detected in 21 (72%) on sonography. Sensitivities for SSFP *vs* 3D GRE MR respectively in PE detection were 52% *vs* 62% on a per-embolus basis, and 52% *vs* 94% on a per-patient basis.
Sensitivities for SSFP *vs* 3D GRE MR respectively in DVT detection were 73% vs 80% on a per thrombus basis, and 85% vs 93% on a per-patient basis. Five (28%) patients without PE showed DVT, whereas two patients without DVT had PE.
Conclusion: Combined MR imaging of acute PE and DVT is a one-stop-shopping examination and may be considered a second-line modality in patients with contraindications to CTA. Unenhanced SSFP can be used for diagnosing PE or DVT in pregnant patients.

B-0302 10:57

Decreased left atrial volume predicts higher mortality in patients with acute pulmonary embolism

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Purpose: To investigate the association between the volumes of the right and left cardiac ventricles and atria with adverse prognosis in acute pulmonary embolism (PE) using CT pulmonary angiography (CTPA).
Methods and Materials: We retrospectively analysed 450 consecutive patients diagnosed with acute PE by non-gated CTPA between 1.1.2009 and 31.12.2010. Each CTPA was investigated by measuring the right ventricular (RV) and left ventricular (LV) diameter ratio, and by a novel volumetric analysis software which provides the volumes of the LV, RV, right atrium (RA) and left atrium (LA) automatically. The association with 30 days mortality was analysed.
Results: Seventy-nine (17.5%) patients were excluded due to technical and patient-related factors. Out of 371 patients that were included in the final study group, 39 (10.5%) died within 30 days. Mortality was significantly associated with reduced LA volumes (odds ratio =1.49, P=0.016 for 20 ml decrease) and

higher ratios between the volumes of RA/LA (odds ratio =1.91, P=0.031). No significant association was found between mortality and RV/LV diameters, RV, LV and RA volumes, age and gender. Analysis of the influence of various measurements on mortality revealed that RA/LA volume ratio was the best predictor, with a mortality of 19.8% for the 111 patients with the RA/LA volume ratio ≥1.315, and of 6.5% among the 260 patients with RA/LA volume ratio < 1.315 (P=0.003).
Conclusion: RA/LA volume ratio ≥1.3 is associated with higher mortality in 30 days. Volumetric analysis of the heart using CTPA data may be useful for risk stratification in acute PE.
Author Disclosures:
G. Aviram: Research/Grant Support; Philips Healthcare.

B-0303 11:06

Dual-energy CT perfusion and angiography in chronic thromboembolic pulmonary hypertension: diagnostic accuracy and concordance with radionuclide scintigraphy

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Purpose: To evaluate the diagnostic accuracy of dual-energy computed tomography (DECT) perfusion and angiography versus ventilation/perfusion (V/Q) scintigraphy in chronic thromboembolic pulmonary hypertension (CTEPH), and to assess the per-segment concordance rate of DECT and scintigraphy.
Methods and Materials: Forty consecutive patients with proven pulmonary hypertension underwent V/Q scintigraphy and DECT perfusion and angiography. Each imaging technique was assessed for the location of segmental defects. Diagnosis of CTEPH was established when at least one segmental perfusion defect was detected by scintigraphy. Diagnostic accuracy of DECT perfusion and angiography was assessed and compared with scintigraphy. In CTEPH patients, the per-segment concordance between scintigraphy and DECT perfusion/angiography was calculated.
Results: Fourteen patients were diagnosed with CTEPH and 26 with other aetiologies. DECT perfusion and angiography correctly identified all CTEPH patients with sensitivity/specificity values of 1/0.92 and 1/0.93, respectively. At a segmental level, DECT perfusion showed moderate agreement (κ=0.44) with scintigraphy. Agreement between CT angiography and scintigraphy ranged from fair (κ=0.31) to slight (κ=0.09) depending on whether completely or partially occlusive patterns were considered, respectively.
Conclusion: Both DECT perfusion and angiography show satisfactory performance for the diagnosis of CTEPH. DECT perfusion is more accurate than angiography at identifying the segmental location of abnormalities.

B-0304 11:15

Impact of perfusion imaging on the assessment of peripheral chronic pulmonary thromboembolism (CPTE): clinical experience in 62 patients

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Purpose: To evaluate the impact of perfusion imaging on the detection of peripheral chronic pulmonary thromboembolism (CPTE).
Methods and Materials: 62 patients with CPTE underwent a dual-source, dual-energy CT angiographic examination with (a) reconstruction of diagnostic (i.e., averaged images from both tubes) and pulmonary blood volume (PBV) images; (b) enabling separate depiction of peripheral chronic CPTE on diagnostic images and perfusion defects on MPRs of PBV images. On diagnostic scans, the CT features of peripheral CPTE included stenosed arterial branches and/or endoluminal filling defects within segmental and subsegmental arteries. On PBV images, pulmonary embolism-type defects consisted of triangular, pleural-based and sharply marginated hypoattenuated areas which were recorded at a segmental level (20 segments/patient; total: 1240 segments). The readings of diagnostic and perfusion images were independently performed by two readers.
Results: On diagnostic images: (a) the analysis of segmental arteries depicted CT features of CPTE within 476 segments; (b) the analysis of both segmental and subsegmental arteries depicted CT features of CPTE within 872 segments. PBV imaging depicted: (a) 313 segments with perfusion defects at the level of which segmental arteries had not been diagnosed with CPTE, increasing the number of segments affected by CPTE by 66% (313/476); (b) 66 segments with perfusion defects at the level of which subsegmental arteries had not been diagnosed with CPTE, increasing the number of segments affected by CPTE by 7.5% (66/872).
Conclusion: The reading of PBV images enables depiction of a greater number of segments involved in peripheral CPTE.

B-0305 11:24

Correlation between DE-CTPA-based iodine map defect extensions and clinical parameters in patients with chronic thromboembolic pulmonary disease detected at DECT: an initial experience

M. Paoletti, C. Capone, D. Stoppa, A. Valentini, E.M. Bassi, M. Morsolini, V. Grazioli, A.M. D'Armini, R. Dore; *Pavia/IT*

Purpose: To determine if perfusion-based iodine map generated by postprocessing of DE-CTPA (dual-energy computed tomography pulmonary angiography) data can correlate with mPAP (mean pulmonary arterial pressure) and PVR (pulmonary vascular resistance) and the extension of vascular disease in patients with chronic thromboembolic pulmonary disease.
Methods and Materials: 33 consecutive patients with chronic thromboembolic pulmonary disease (18 men and 15 women, mean age 56) underwent DE-CTPA. Patients were divided into two groups: group A: 12 pts, mPAP < 25 mmHg, NYHA 2-4; group B: 21 pts, mPAP ≥ 25 mmHg, NYHA 2-4. Postprocessing was used to generate iodine-distribution maps. A two-operators-based subjective evaluation and a semi-automatic quantification of perfusion defects were performed. A modified Qanadli score was performed to assess the vascular obstruction in the pulmonary vascular tree in the whole population and in the two groups. The parenchymal density assessment was performed by a dedicated software.
Results: There was a statistical significant difference between the two groups ($p < 0.01$) considering the subjective perfusion quantification and the vascular obstruction score. The study also showed a moderate positive correlation between the subjective perfusion score and both mPAP and PVR; a moderate negative correlation was present between the obstruction score and mPAP. No clear correlation was evident comparing mPAP and PVR with the parenchymal density and the semi-automatic perfusion quantification.
Conclusion: Subjective perfusion quantification and the modified Qanadli score demonstrated a greater disease degree in the group with mPAP ≥ 25 mmHg. A correlation exists between the clinical parameters and the subjective perfusion quantification.

B-0306 11:33

Complex contrast injection protocol reduces inflow streak artefacts at the cervico-thoracic junction during computed tomography of the thorax

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Purpose: To investigate enhancement of thoracic vasculature during computed tomography (CT) of the thorax using a complex injection contrast protocol.
Methods and Materials: 300 patients underwent routine post-contrast thorax CT using a 64 channel CT scanner. Patients were allocated to one of two contrast protocols: Protocol A, the department's standard protocol, consisting of a caudocranial scan direction with 100 mL of contrast intravenously injected as a single bolus; Protocol B, involving a caudocranial scan direction and 100 mL of contrast using a complex injection protocol. Each protocol employed a dual barrel injector with 100 mL of saline and a fixed scan delay of 70 sec prior to acquisition. Attenuation profiles of the thoracic arteries and veins were measured with the arteriovenous contrast ratios (AVCR) calculated. Receiver operating characteristic (ROC) analysis was performed using DBM methodology.
Results: Arterial attenuation was up to 24% ($p < 0.03$) higher following regimen B compared with A. Attenuation in the veins were significantly lower in regimen B than in regimen A with a maximum reduction of up to 84% ($p < 0.0001$). With Regimen B, there were significant ($p < 0.002$) improvements in AVCR at a variety of anatomical sites. The ROC analysis demonstrated a significantly higher Az score for the novel protocol compared with Regimen A ($p < 0.05$) with inter-reader agreement increasing from poor to excellent.
Conclusion: Significant improvements in visualisation of thoracic vasculature can be achieved at the cervico-thoracic junction using a complex injection contrast protocol.

B-0307 11:42

Dual-energy CT with reduced iodine load: a new option for standard chest CTA in patients with superior vena cava syndrome

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Purpose: To evaluate the possibilities of dual-energy CT in the context of superior vena cava syndrome (SVCS).
Methods and Materials: 41 patients underwent a dual-source, dual-energy CT angiographic examination with administration of a low-concentrated contrast agent (160 mg iodine /mL) and reconstruction of 3 series of images (i.e., the 2 polychromatic series acquired at 80 and 140 kV; the fused images from both tubes, equivalent to images acquired at 120 kV). The following parameters were analysed: (a) the CNR and SNR within the SVC, pulmonary arteries and aorta; (b) the presence of streak artifacts at the level of 3 nodal stations (i.e., 2R, 4R, 10R).

Results: Fused images provided (a) good to excellent opacification within the SVC (n=40; 98%) without artifacts at the level of 2R (n=26; 63%), 4R (n=40; 98%) and 10 R (n=41; 100%); (b) analyzability of pulmonary arteries down to the subsegmental level (n=31; 76%); and (c) good to excellent opacification of the aorta (n=35; 85%). In 29 patients (29/41; 71%), averaged images alone provided optimal evaluation of all vascular compartments; in 12 patients (12/41; 29%), they had to be completed by images at 140 kV (n=6) to suppress artifacts at the level of the nodal station 2R and/or images at 80 kV (n=10) to improve the CNR at the level of subsegmental pulmonary arteries and/or the aorta.
Conclusion: Dual-energy CT enables combination of optimal evaluation of SVCS and diagnostic image quality at the level of the other thoracic circulations.

B-0308 11:51

Impact of iterative reconstruction on CNR and SNR in a 256-slice MDCT low-dose triple-rule-out angiography
B.M. Gramer, V. Phi van, M. Rasper, E.J. Rummeny, A. Huber; *Munich/DE*

Purpose: To evaluate the ability of a new iterative reconstruction algorithm (IR), iDose^{4,} for the improvement of quantitative image quality (IQ) in triple-rule-out (TRO) angiography in emergency patients and to investigate the feasibility of radiation dose reduction.
Methods and Materials: ECG-gated 256-slice MDCT TRO angiography scans were performed in 52 patients at 120 ± 0 kVp and 120 ± 0 mAs. Data were reconstructed with a conventional standard filtered back projection (FBP) and with seven different levels (L) of iterative reconstruction (IR (L1 - L7)). Image noise, contrast-to-noise ratio (CNR) and signal-to-noise ratio (SNR) were evaluated for all data. In addition, the results of the emergency TRO-examination were investigated.
Results: Noise was reduced from 34 ± 7 (FBP) to 16 ± 4 (IR Level 7). IR improved SNR (34 ± 7.3 with FBP) up to 18.1 ± 15.9 (IR Level 7). Likewise, CNR increased from 8.9 ± 0.5 (FBP) to 18.8 ± 2.47 (IR Level 7). With the TRO-examination in 14 % it was found a pulmonary embolism, in 6 % a coronary disease and in 2 % a aortic dissection.
Conclusion: IR improves SNR and CNR compared to FBP, thus a reduction of 30% radiation dose seems feasible. In future, several investigations concerning the comparison between low-dose, high-dose protocols need to be further evaluated.

10:30 - 12:00 **Board Room B**

Oncologic Imaging

SS 516
Trends in CT

Moderator
A. Gogbashian; Middlesex/UK
G. Petralia; Milan/IT

B-0309 10:30

Integrated metabolic-perfusion assessment of non-small cell lung cancer using 18 F-FDG PET/CT and perfusion-CT
L. Calandriello, A. del Ciello, A. Larici, L. Leccisotti, A. Giordano, L. Bonomo; *Rome/IT (lcalan@hotmail.it)*

Purpose: To assess the correlation between metabolic and perfusion parameters in patients with non-small-cell lung cancer (NSCLC) who underwent 18 F-FDG-PET/CT and perfusion-CT.
Methods and Materials: 20 patients with clinically resectable (stage Ia-IIIa) NSCLC underwent PET/CT and whole-tumor perfusion-CT within 2 weeks before surgery. Peak standardised uptake value (SUVpeak), SUVmean and metabolic tumor volume (MTV) calculated using manual (mMTV) and automated (aMTV) contouring method with a threshold of 40% of the maximum SUV, were used as metabolic parameters. Blood Flow (BF) was determined as perfusion parameter. Patients were divided into two subgroups according to maximum lesion diameter (≤30 mm or > 30 mm). We assessed the correlation between perfusion and metabolic parameters in overall population and within each subgroup. The difference of each parameter within subgroups was calculated. Pearson coefficient and Mann-Whitney test were used for statistical analysis; a p-value ≤0.05 was considered significant.
Results: No correlation was found between perfusion and metabolic parameters in overall population. After dividing Patients into two groups, a statistically significant negative correlation was found between volumetric metabolic parameters mMTV/aMTV and BF in Patients with tumor maximum diameter > 30 mm (p:0.04 for both). A significant difference of BF, SUVpeak, SUVmean, aMTV and mMTV was found between subgroups (p:0.001;p:0.04;p:0.02;p:0.001;p:0.001): in bigger lesions BF tends to decrease while metabolic parameters tend to increase.
Conclusion: Volumetric metabolic parameters correlate with perfusion parameters depending on tumor size. PET/CT and Perfusion-CT parameters cannot be considered equivalent in the assessment of NSCLC but their combined evaluation can provide a better tumor characterisation with possible future application.

B-0310 10:39

CT perfusion parameters as a prognostic biomarker in patients with non-small-cell lung cancer
L. Calandriello, A. Larici, M. Occhipinti, A. Infante, G. Petrone, L. Bonomo; *Rome/IT (lcalan@hotmail.it)*

Purpose: To correlate CT perfusion parameters with histopathological prognostic factors in Patients with clinically operable early stage (Ia - IIIa) NSCLC and to assess the correlation between these parameters and recurrence in our study population
Methods and Materials: 25 patients with clinically resectable NSCLC underwent perfusion CT examination using 64 row CT and contrast medium injection (50 ml, @ 5 ml/sec) before surgery. CT perfusion parameters considered were: Blood Flow (BF) and Blood Volume (BV). Maximum tumor diameter was also measured. Histopathological factors assessed were: tumor stage and grade, extent of necrosis (≤10% or > 10%) and microvessels density (MVD). After surgery Patients underwent clinico-radiological follow-up. Pearson correlation, Anova test, T Student test and Chi-squared test were used for statistical analysis. A p value < 0.05 was considered significant
Results: BF values were correlated with pathological stage (p:0.008). BF and BV values were statistically lower in tumors with maximum diameter > 3 cm (p:0.001; p:0.05) and with necrosis > 10%(p:0.01; p:0.05). In addiction BV values were statistically associated with MVD (p:0.04). No correlation was found between perfusion parameters and tumor grading. Mean follow-up was 15 months with recurrence disease occurred in 7 Patients. Pathological stage (p:0.04), maximum tumor diameter (p:0.01) and BF values (p:0.05) were significantly associated with the risk of recurrence
Conclusion: Perfusion parameters in Pts with early stage (IIa-IIIa) clinically operable NSCLC correlate with histopathological prognostic factors and may serve as pre-treatment prognostic biomarker of risk of recurrence

B-0311 10:48

Clinical application of dual-phase C-arm CT with a single injection to detect hepatocellular carcinoma and metastasis during hepatic arteriography
J. Wang[1], K.-Y. Huang[1], Z.-G. Zhuang[1], J.-C. Chi[1], J.-J. Cheng[1], J. Beilner[1], Y. Deuerling-Zheng[2]; [1]*Shanghai/CN*, [2]*Forchheim/DE*

Purpose: To investigate the feasibility of using existing 3D-DSA acquisition to perform dual-phase C-arm CT with a single contrast injection for the detection of tumour lesions and blood supply during TACE.
Methods and Materials: 10 cases were collected from July 2012 to May 2013, who received dual phase C-arm CT (Artis Zeego, Siemens, Germany) during TACE. We injected 48 ml (diluted to 33%) contrast media at a rate of 4 ml/s through a 5 F catheter placed in the celiac trunk, manually triggered 3D-DSA scan protocol was used to obtain arterial and portal venous phase images. First run was initiated 2 seconds after contrast media injection. Second run was triggered 2 seconds after the C-arm rotates back to initial position. CT-like images in sagittal, transversal and coronal orientation were reconstructed using 10 mm-thick maximal intensity projection (MIP) to visualise small vessels and lesions.
Results: Out of the 10 cases, image quality of 2 cases found to be insufficient for diagnosis due to metal and motion artefacts. 50% (5 of 10 patients) lesions were found in both phases; 20% more lesions were detected in portal venous phase and 10% more in arterial phase. Ring-enhancement could be seen for metastases in venous phase.
Conclusion: Application of intra-procedural dual-phase C-arm CT for TACE could visualise hepatic lesions more clearly at least in one phase. It could potentially offer a more accurate real-time planning for super-selective embolisation. Moreover, sequential TACE and portal vein embolisation could be considered in cases lesions were only detected in portal venous phase.
Author Disclosures:
K. Huang: Consultant; Siemens. **J. Beilner:** Consultant; Siemens. **Y. Deuerling-Zheng:** Consultant; Siemens.

B-0312 10:57

Selection of colon cancer patients for neoadjuvant chemotherapy by preoperative CT

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Purpose: Preoperative staging is essential to plan correct treatment of colon cancer and calls for objective, accurate methods with sufficient reproducibility. This is a prerequisite for the introduction of neoadjuvant chemotherapy, which represents a new treatment option. The aim was evaluate the diagnostic accuracy of multislice computed tomography (CT) in local staging of colon cancer correlated with histopathological parameters, including criteria for adjuvant chemotherapy.
Methods and Materials: A total of 74 patients were included. All had preoperative CT scans and surgical resection of their colon tumours. Tumour stage (T-stage), extramural tumour invasion (ETI), nodal stage (N-stage), extramural venous invasion (EVI), and the distance from tumour to nearest retroperitoneal fascia (DRF) were assessed on the CT scan and compared blindly with the results of the pathological examination, which also included evaluation of the criteria for adjuvant chemotherapy. Advanced tumours were defined as T3 with ETI ≥ 5 mm or T4.
Results: Sixty-nine percent of the tumours were correctly T-staged by CT, 7% were overstaged and 24% were understaged. As to correct recognition of ETI on the CT scan, the observer was 70% accurate compared with histopathology (sensitivity 64%; specificity 78%). N-stage, EVI, and DRF had poor accuracy: 53%; 55% and 63%. All patients with advanced tumours on CT fulfilled the criteria for adjuvant chemotherapy. PV+ value: 100% (95% CI: 88.0-100).
Conclusion: CT has a potential as the imaging modality of choice in the preoperative selection of advanced tumours suitable for neoadjuvant chemotherapy. This can be done without overtreatment of low-risk patients.

B-0313 11:06

Vertebral marrow enhancement in chest MDCT studies of oncology patients without superior vena cava obstruction

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Purpose: VM is a transient contrast vertebral opacification that may be mistaken for metastases in oncology patients with SVC obstruction. Our aim was to demonstrate that VM can be found in patients with thoracic venous collateral vessels (VC) without SVC obstruction.
Methods and Materials: Chest MDCT exams of 56 patients with VC without VCS obstruction were evaluated. Two groups based on the presence of VC due to venous thrombosis (VT) at the brachiocephalic and/or subclavian and axillary veins (group 1, n=28) or due to anatomical compression of the subclavian vein, without VT (group 2, n=28) were formed. MDCT exams were performed with arms in upright position, after injection of 100 ml of Iohexol at 2 ml/s in the arm with VT/compression. VC was classified in shoulder, mediastinal, anterior chest wall, neck and posterior paravertebral according their distribution. One point was assigned for each anatomical area. Intensity of VC was defined by the summation of these points. Images were compared with a normal follow MDCT of the same patient. Fisher's test and Chi square of Pearson test were performed.
Results: Nine patients of group 1 showed 49 VM, whereas no patient of group 2 had VM (p= 0.002). Patients with VM had VC in posterior paravertebral areas, mediastinum or neck more frequently than those without VM (p=0.005, p=0.000, p=0.017). 66.6 % of patients with VM presented 3 or more VC intensity points, whereas 19.14% of patients without VM showed that intensity (p=0.008).
Conclusion: VM was found only in oncology patients with VC and VT of the brachiocephalic and/or subclavian-axillary veins without VCS obstruction.

B-0314 11:15

Dual source dual-energy CT in patients with advanced gastrointestinal stromal tumour: image quality and accuracy of hepatic metastasis detection with virtual monoenergetic imaging

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Purpose: To compare in dual-energy CT (DECT) conventionally reconstructed polyenergetic images (PEI) at 120 peak kilovoltage (kVp) to virtual monoenergetic images (MEI) at different kiloelectron volt (keV) levels for evaluation of gastrointestinal stromal tumor (GIST) hepatic metastases with regard to objective (IQob) as well as subjective (IQsub) image quality and diagnostic accuracy in metastasis detection assessed by readers of varying experience.
Methods and Materials: From 50 examinations of 17 GIST patients undergoing abdominal dual-source DECT for staging and follow-up, PEI and 9 MEI in 10-keV intervals from 40-120 keV were reconstructed. Liver contrast-to-noise ratios (CNR) and metastasis-to-liver ratios were calculated. MEI reconstructions with the highest IQob were compared to PEI for IQsub and diagnostic accuracy by one experienced (ER) and one inexperienced reader (IR).
Results: MEI at 70 keV had highest IQob with equal liver CNR and metastasis-to-liver ratio compared to PEI. The ER rated 70 keV MEI and PEI equally high (median 4), whereas the IR rated IQsub best in 70 keV MEI (median 5). Diagnostic accuracy was equal in 70 keV MEI and PEI for ER (AUC= 1.00) and better in 70 keV MEI than in PEI for IR (AUC= 0.98 and 0.96, $p > 0.05$).
Conclusion: MEI at 70 keV provided an IQob equivalent to PEI. Regarding the IR, IQsub was impoved in 70 keV MEI compared to PEI and a tendency towards higher diagnostic accuracy was seen. Therefore, inexperienced readers might improve their diagnostic confidence in the detection of hepatic GIST metastases by evaluating MEI reconstructions at 70keV.

B-0315 11:24

Iterative reconstructions safire applied to dual-energy CT images for increasing detectability of small low-contrast hypoattenuating liver metastases

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Purpose: To optimise DECT protocols with Sinogram Affirmed Iterative Reconstruction (SAFIRE) algorithms in order to improve detection of small hypodense liver metastases.
Methods and Materials: A DECT portal-phase acquisition of two healthy livers was reconstructed using standard filtered-back-projection (FBP) and four SAFIRE reconstruction schemes obtained by combining two iterative medium-smooth filters (I26,I30) and two different strengths (S3,S5). SAFIRE reconstructions were performed on both whole-dose (DE-composition 0.5) and half-dose 80 kVp images, while FBP reconstructions were applied to DE-composition images only, resulting in 9 reconstructions per patient. Eight 6-mm spherical lesions were simulated in random positions for each series, resulting in 144 simulated lesions. A -26 HU lesion-to-liver contrast (LLC) was selected for DE-composition images and a -33.8 HU for 80 kVp images, according to the results of a preliminary study on 29 colorectal cancer liver metastases demonstrating a 30% increased LLC in 80 kVp images compared to DE-composition. Four expert radiologists performed a detectability test and rated the overall quality, noise and sharpness (5-point scale) in all images.
Results: FBP reconstructions allowed only 13% lesions to be detected. Best performance was obtained with S5 reconstructions on DE-composition series (47% and 61% lesions detected with I26 and I30 kernels, respectively). 80 kVp series provided worse performances compared to DE-composition series. Contrary to expectations within DE-composition series, S5 image quality ratings proved to be worse than S3 and FBP, while 80 kVp series resulted the worst in all.
Conclusion: SAFIRE has the potential to increase sensitivity for small low-contrast hypodense liver lesions.

B-0316 11:33

Assessment of early treatment effects of targeted tumour therapy by CT: systematic comparison of dual-energy CT, conventional contrast-enhanced CT and dynamic contrast-enhanced CT

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Purpose: Comparison of dual-energy computed tomography (DE-CT), dynamic contrast-enhanced CT (DCE-CT) and conventional contrast-enhanced CT (CE-CT) in the assessment of early treatment response after targeted tumor therapy in a preclinical setting.
Methods and Materials: A rat GS9L glioma model was examined with contrast-enhanced dynamic DE-CT measurements (dual source CT, 80 kV/140 kV) before and on days 1 and 4 after start of daily regorafenib (n=8) or placebo (n=8)treatment. Based on that DE-CT (60s p.i., 80/140 kV) derived iodine maps and the DCE-CT (0-30s p.i., 80 kV) based parameters maps for blood flow (BF), blood volume (BV), and vascular permeability (PMB) were calculated and compared to conventional CE-CT (60s p.i., 80 kV).
Results: The regorafenib group exhibited a significantly lower tumor iodine concentration and a significantly lower PMB in the tumor on day 1 and 4 compared to baseline, which was not observed for the placebo group. CE-CT showed a significant decrease in tumor density on day 4 but not on day 1. The DE-CT derived iodine concentrations correlated well with CE-CT tumor attenuation and PMB but not with BV or BF.

Conclusion: DE-CT derived tumor iodine concentrations allow an early treatment monitoring of targeted tumor therapy in good agreement with the DCE-CT parameter PMB. Both methods DE-CT and DCE-CT showed a superior performance compared to single energy CE-CT based measurement of tumor attenuations.
Author Disclosures:
G. Jost: Employee; Bayer AG. **A. Huppertz:** Employee; Siemens AG. **H. Pietsch:** Employee; Bayer AG.

B-0317 11:42

4th generation iterative reconstruction algorithm in low dose whole-body CT in comparison with standard dose examination for follow-up of oncologic patients

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Purpose: To compare radiation dose and image quality of low dose protocol with iterative reconstruction algorithm (iDose4) with standard dose protocol CT examination for follow-up of oncologic patients.
Methods and Materials: 51 patients (32 male; mean age 69.5±10.5 years, mean BMI 24.9±4.1) with malignant disease underwent, during follow-up, low-dose whole-body CT scan in a single venous phase (256-row CT, Brilliance, Philips, iDose4 modulation) with the following parameters: 120 kV, variable mAs (with dose modulation), slice thickness 2 mm. The patients underwent also standard dose examination on 16-rows CT scan (Philips), with 120 kV, 200-400 mAs (depending on patient weight), slice thickness 2 mm. Image noise, sharpness and diagnostic quality were evaluated using a 4-point scale. Dose-length product (DLP) was calculated and data from both examinations were compared and statistically analysed.
Results: Total DLP was significantly ($p < 0.001$) lower in low-dose examinations as compared to standard-dose CT studies (1010.0±375.1 mGy*cm vs 1404.9±281.6), with an overall dose reduction of 29%. Density values in liver and vessels were higher in low-dose images (liver 111.7±17.2 HU vs 101.7±16.6; aorta 164.8±17.8 vs 149.6±22.7, $p < 0.001$). Qualitative analysis didn't reveal significant difference in image noise and diagnostic quality of the two groups.
Conclusion: iDose4 reconstruction algorithm allows significant reduction (29%) of radiation dose without loss of diagnostic quality representing an useful technique to reduce dose exposure in oncologic patients.

B-0318 11:51

Filtered back projection vs adaptive statistical iterative reconstruction in staging-CT: comparison of dose and image quality in NET-patients

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Purpose: The purpose of this study was to investigate, if dose reduction via adaptive statistical iterative reconstruction (ASIR) affects image quality and diagnostic evidence in patients with neuroendocrine tumour (NET).
Methods and Materials: This prospective, single-center study was performed with a 64-section CT-scanner (LightSpeed VCT; GE Healthcare), updated with ASIR technology. 16 patients with histologically proven NET underwent staging-CT (thorax and abdomen) with filtered back projection (FBP) (protocol A) and with ASIR 40% (protocol B) in follow-up, by using identical scan parameters. To evaluate image quality, SNR and CNRs were calculated. In addition, subjective 5-grade scoring (1 insufficient to 5 excellent) was performed by two experienced and blinded readers.
Results: Our results show that, with matched scan length (596±75 mm [A], 609±38 mm [B]), protocol B reduced the DLP by 35.7% (1053.1±404.8 mGy*cm [A], 676.9±248.5 mGy*cm [B]). Protocol B increased SNR (9.8±2.7 [A], 12.9±4.5 [B]) and CNR (complete tumor-to-liver, 3.2±2.1 [A], 4.3±2.7 [B]). There were no significant differences in subjective image quality scoring: noise (4.2±0.8 [A], 4.0±0.8 [B]), contrast (4.4±0.7 [A], 4.1±0.8 [B]), visibility of small structures (4.4±0.7 [A], 4.2±0.8 [B]), visibility of suspect lesion (4.8±0.4 [A], 4.8±0.4 [B]), artefacts (5.0±0 [A], 5.0±0 [B]) and diagnostic confidence (5.0±0 [A], 5.0±0 [B]).
Conclusion: In clinical practice, ASIR can be used to reduce radiation dose without decreasing objective image quality and diagnostic confidence in NET-patients.

10:30 - 12:00 **Room E1**

Musculoskeletal

SS 510

Spine: osteoporosis, malignancy and spondylarthropathy

Moderators:
M.P. Aparisi Gomez; Valencia/ES
C. Van Kuijk; Amsterdam/NL

B-0319 10:30

Automatic detection of osteoporotic vertebral fractures in routine thoracic and abdominal MDCT

T. Baum[1], J.S. Bauer[1], T. Netsch[2], T. Klinder[2], M. Dobritz[1], E.J. Rummeny[1], P.B. Noël[1], C. Lorenz[2]; [1]*Munich/DE*, [2]*Hamburg/DE (thbaum@gmx.de)*

Purpose: To develop an automatic spine segmentation algorithm for routine thoracic and abdominal MDCT and use this algorithm to automatically detect osteoporotic vertebral fractures.
Methods and Materials: We retrospectively identified patients older than 45 years of age, who underwent routine contrast-enhanced thoracic and abdominal MDCT. Cross-sectional MDCT images of 71 patients including 8 men and 9 women with osteoporotic vertebral fractures were selected to investigate the performance of our automatic spine segmentation algorithm to detect these fractures. Furthermore, the algorithm was applied to baseline and follow-up MDCT images of 9 patients (4 men and 5 women) with incidental vertebral fractures in the follow-up MDCT. The algorithm localised and identified the vertebrae T5-L5. Each vertebra was automatically segmented by using corresponding vertebrae surface shape models that were adapted to the original images. Anterior, middle, and posterior height of each vertebra was automatically determined, and anterior-posterior-ratio (APR) and middle-posterior-ratio (MPR) were computed. As gold standard, two radiologists graded vertebral fractures from T5 to L5 according to the Genant classification in consensus by using the sagittal reformations.
Results: Using ROC analysis to differentiate vertebrae without versus with prevalent fracture, AUC values of 0.84 and 0.83 were obtained for APR and MPR, respectively ($p < 0.001$). The longitudinal changes in APR and MPR were significantly different between vertebrae without versus with incidental fracture (ΔAPR: -8.5%±8.6% versus -1.6%±4.2%, p=0.002; ΔMPR: -11.4%±7.7% versus -1.2%±1.6%, $p < 0.001$).
Conclusion: The presented algorithm may support radiologists to report currently underdiagnosed osteoporotic vertebral fractures, so that appropriate therapy can be initiated.
Author Disclosures:
J.S. Bauer: Research/Grant Support; Deutsche Forschungsgemeinschaft (DFG BA 4085/1-2). **T. Netsch:** Employee; Philips. **T. Klinder:** Employee; Philips. **C. Lorenz:** Employee; Philips.

B-0320 10:39

Pitfalls in previous dual energy x-ray absorptiometry scans: adherence to International Society of Clinical Densitomery 2007 guideline

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Purpose: Dual-energy X-ray absorptiometry (DXA) is the standard of care for diagnosing osteoporosis and monitoring patients. Inaccurate DXA exams may lead to different mistakes (known as "pitfalls") resulting in erroneous data interpretation and equivocal reports. We evaluated rate and type of errors in previous DXA of patients coming to our institution for a new DXA exam.
Methods and Materials: We prospectively evaluated 2,476 patients who presented at our institution to perform DXA. We excluded patients without previous DXA and those who performed the previous examination at our institution. Two radiologists with 4 years of experience in DXA re-evaluated previous DXA of 498 patients (38 males, 447 females; mean age 68±9 years), according to International Society of Clinical Densitometry (ISCD) 2007 guidelines. Errors were classified in four categories: patient-positioning (PP), data-analysis (DA), artefacts, demographics. When available, previous comparisons among outsource DXA were analysed also for technical errors.
Results: Previous outsource DXA were performed at 37 different centers, with 13±8 patients (mean ± standard deviation) per center. Out of 485 DXA, 451 (93%) had at least one error for a total of 558 errors: 441 (79%) were DA, 66 (12%) PP, 39 (7%) artefacts, and 12 (2%) demographics. Only 42 (9%) had a previous DXA for comparisons, for a total of 57 errors: 31 (54%) were DA, 17 (30%) PP, and 9 (16%) scan mode discrepancies.
Conclusion: More than 90% of previous DXA presented at least one error. ISCD guidelines are very poorly adopted.

B-0321 10:48

Early detection of sacroiliitis using DW imaging

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Purpose: This study proposed to evaluate the value of diffusion-weighted MRI to detect active inflammatory changes in the sacroiliac joints of patients with early axial spondyloarthritis.
Methods and Materials: 36 patients with chronic low back pain underwent clinical and MRI evaluation for axial spondyloarthritis or early ankylosing spondylitis. STIR, contrast-enhanced T1-weighted, fat-saturated T2-weighted, and diffusion-weighted b value1,000 s/mm^2 images were obtained. The presence of subchondral bone marrow oedema, subchondral fatty marrow infiltration, or contrast enhancement in the sacroiliac joints or adjacent enthesitis sites was considered a marker for active inflammatory changes. All MRI sequences were evaluated for the presence of acute inflammatory changes. Mean apparent diffusion coefficient values of diffusion-weighted images were calculated from normal and involved iliac and sacral bones of sacroiliac joints.
Results: ADC values measured from the lesions at b value of 1,000 s/mm2 in patients with sacroiliitis n = 13 were significantly higher than values measured from iliac and sacral bones in patients with low back pain of mechanical origin n = 29. DWI showed sensitivity for detecting acute lesions in early sacroiliitis similar to that of T1-weighted gadolinium images 89.3%DWI vs 91.3%T1+c.
Conclusion: DWI is a sensitive, fast sequence and does not require a contrast agent, which makes it a good and cost-effective alternative for imaging sacroiliac joints. DWI also offers the possibility of quantifying diffusion coefficients of the lesions, which helps to discriminate between normal and involved subchondral bone.

B-0322 10:57

Effects of recent lung transplantation on cortical and trabecular microarchitecture and bone strength in men and women

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Purpose: Organ transplant recipients often suffer from severely impaired bone strength arising of pre-existing osteoporosis and bone disease aggravation due to immunosuppressive treatment after surgery. Lung transplant recipients are under an intense post-transplant drug regimen and fracture rates are high. Despite, low bone mineral density and altered states of bone turnover have been reported, bone microarchitecture status has been scarcely analysed.
Methods and Materials: After recovery from surgery, 61 patients (female: n=31, male: n=30; mean age: 45.9±14.9), and 60 healthy, age and gender-matched controls (Co) underwent high resolution peripheral quantitative computed tomography (HR-pQCT; SCANCO Medical AG) of the ultradistal radius. Volumetric bone mineral density, trabecular and cortical bone microarchitecture and bone strength were assessed. ANCOVA was used to compare mean differences between female and male LuTX patients and Co.
Results: Female transplant recipients exhibited larger and more heterogeneous cortical pores (+13.3%, p=0.009; +16.7%, p=0.029), greater trabecular heterogeneity (+80%, p=0.044) and lower mid-trabecular BMD (-17.9%, p=0.049) than healthy women. Male transplantation recipients had lower cortical area (-21.3%, p=0.001), global BMD (-19.5%, p=0.002), trabecular BMD (-22.2%, p=0.003), BV/TV (-23%, p=0.002), trabecular number (-13%, p=0.006), trabecular thickness (-12.5%, p=0.023), stiffness (-21%, p=0.001), failure force (-21%, $p < 0.001$), overall bone strength (-24%, $p < 0.001$) and larger trabecular separation and network heterogeneity (+25.6%, p=0.015; (+50%, p=0.036) than healthy men.
Conclusion: Male and female patients with recent lung transplantation exhibit relevant deficits in trabecular and cortical bone quality and bone strength. Furthermore, they exhibited major disturbances in gender-specific bone characteristics.

B-0323 11:06

Bone microarchitecture in thalassaemia

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Purpose: To assess the microarchitecture of the bone density of patients with thalassaemia using HR-pQCT and compared to DXA.
Methods and Materials: In 17 patients with beta-thalassaemia major (n=10), -intermedia (n=6), and CDA-II (n=1), the bone marrow density (BMD) of lumbar spine (LS) and total hip was measured by DXA. BMD Z-scores were calculated; volumetric BMD and the trabecular architecture of the non-dominant distal radius and tibia by HR-pQCT were assessed. Liver iron concentration and endocrinological parameters were determined. Non-parametric statistical analysis was used.
Results: In 15 patients, low BMD values (LS Z-score range: -1.1 to -3.1) measured by DXA were significantly correlated with total volumetric density (p=0.002) measured by HR-pQCT at the distal radius. In 6 patients with latent hypogonadism, the trabecular inhomogeneity parameter at the distal radius deviated by more than 100% from the upper normal value. Patients with hypogonadism (n=9) were significantly different from normals with respect to radial TbSp SD (p=0.02), but not to LS Z-score. Patients with fractures (n=5) had lower total densities (p=0.02) and trabecular TbSp SD (p=0.02) at the tibia and started blood transfusions (Tx-age) at a higher age (p=0.023). Z-scores did not reflect the fracture risk in this patient group (p=0.11). Only the trabecular thickness of the tibia seems to be correlated with the Tx-age (Rs=0.62, p=0.007). Liver iron was mainly correlated with tibial TbSp SD (Rs=0.54, p=0.025).
Conclusion: In thalassaemia, BMD Z-scores seem to underestimate fracture risk because a normal cortical thickness and density may conceal a porous trabecular structure.

B-0324 11:15

Durie-Salmon plus vs international staging system: the impact of MRI in the staging of multiple mieloma

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Purpose: The Durie Salmon Plus (DDS+) is a recently developed staging system for Multiple Myeloma (MM), based on the number of bone lesions detected with MRI or FDG PET/CT and on few clinical parameters. Given that the DSS+ has not been validated yet, the aim of our study is to compare the International Staging System (ISS), a widely used system for MM that evaluates only laboratory parameters, with the DSS+, according to patients' survival rates and response to therapy.
Methods and Materials: We retrospectively enrolled 52 patients, diagnosed with MM during 2004-2008, who underwent contrast-enhanced MRI (1.5 T)in our department at the time of diagnosis. Patients were staged with both ISS and DSS+ and the two systems were then compared according to survival rate, response to therapy and disease-free survival (Student's-T test, COX and Kaplan-Meier analysis), during a 5-year follow-up.
Results: From ISS to DSS+ 22 patients have been upstaged, 11 have been downstaged and 19 have been staged the same. After therapy 40/52 patients (76.9%) achieved a complete response, with a mean free-disease survival of 49.5 months. During the follow-up 4/52 patients (7.7%) have died; according to DSS+ all these 4 patients were at stage III, only one according to ISS. No statistically significant difference was found between the two staging system considering response to therapy.
Conclusion: Our data indicate that DSS+ has a great potential in staging MM patients, for survival and therapy efficacy prediction. To our knowledge, this is the first study designed to compare these two staging systems.

B-0325 11:24

Association of osteolyses with vertebral fractures in patients with multiple myeloma

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Purpose: In patients with multiple myeloma (MM), computed tomography is widely used for staging and to detect fractures. We investigated the association of prevalent vertebral fractures in MM patients with clinical and radiological features of the disease.
Methods and Materials: 128 MM patients underwent whole body low-dose CT in clinical routine with 1.5-mm slice thickness, 120 kVp and approximately 100 mAs. Two radiologists reported on following parameters based on predefined criteria: vertebral fractures, general fracture risk, osteopenia, trabecular sclerosis, extramedullary MM manifestations, osteolyses up to a size of 8 mm and larger than 8 mm. Age-adjusted multivariate logistic regression models were calculated to describe the association of these parameters with prevalent fractures.
Results: The prevalence of vertebral fractures was 49%. Patients with fractures were comparable in age to patients without fractures (63 vs 64 years of average, $p > 0.6$). In age-adjusted logistic regression, the OR for prevalent vertebral fractures in women showed the strongest association to the prevalence of osteolytic lesions, regardless of size. In both women and men, patients with larger osteolyses did not show a higher prevalence of fractures. In men, the osteopenia showed the strongest association to fracture risk with an OR of 2.8 (1.6 -4.7). Suspected fracture risk was associated to fractures with an OR of 2.3 (1.6 - 3.8).
Conclusion: The prevalence of vertebral fractures in myeloma patients is associated with osteopenia and osteolytic changes. Prevalence of larger osteolyses did not show a higher association to fractures than patients with smaller osteolytic changes.

B-0326 11:33

Determination of the best combination of b-values for ADC-based assessment of benign and malignant vertebral body fractures with a diffusion-weighted ssTSE sequence

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Purpose: Finding the best combination of b-values for apparent-diffusion-coefficient (ADC)-based assessment of acute benign and malignant vertebral body fractures using a ssTSE-sequence.
Methods and Materials: 26 acute benign (mean age 69, 31.5-86.2 years) and 20 malignant vertebral fractures (mean age 63.4, 24.7-86.4 years). Standard morphological sequences and a diffusion-weighted (DW) single-shot turbo spin echo (ssTSE) sequence at different b-values (100, 250, 400, 600 s/mm²) were acquired at 1.5 T. ADCs were determined based on regions of interest (ROIs), manually adapted to hyperintense areas on STIR in the fractured vertebral bodies. Combinations of two to four b-values were used to calculate the ADC, using a least-squares algorithm. Statistically significant differences were determined with the Student's t-test and Mann-Whitney-U test. ROC analysis and the Youden-index were used to determine cut-off values with the highest sensitivity and specificity.
Results: Benign fractures had significantly higher ADCs than malignant fractures (except for the combination of b=400 s/mm^2 and b=600 s/mm^2). Higher b-values resulted in lower ADCs than calculated with low b-values. ADCs calculated with b=100 and 400 s/mm^2 had the highest AUC (0.85). The second highest AUC (0.829) showed the ADCs calculated with b=100, 250, and 400 s/mm^2. The Youden-index with equal weight given to sensitivity and specificity suggests to use an ADC calculated with b=100, 250, and 400 s/mm^2 (cut-off ADC< 1.7 ×10-3 mm^2/s) to best diagnose malignancy (sensitivity=85%, specificity=84.6%).

Conclusion: The combination of low to intermediate b-values (b=100,250,400s/mm^2) provides the best diagnostic capability for ADC-based differentiation of acute benign and malignant vertebral body fractures using a diffusion-weighted ssTSE sequence.

B-0327 11:42

Assessing structural changes in axial spondyloarthritis using a low-dose biplanar imaging system (EOS)

A. Molto[1], V. Freire[1], A. Feydy[1], W.P. Maksymowych[2], M. Benhamou[1], F. Rannou[1], M. Dougados[1], L. Gossec[1], J.-L. Drapé[1]; [1]*Paris/FR*, [2]*Edmonton, AB/CA (antoine.feydy@cch.aphp.fr)*

Purpose: Patients with axial spondyloarthritis (SpA) experience repeated spine imaging. EOS is a new low-dose imaging system with significantly lower irradiation than conventional radiography (CR). The objective was to explore the EOS performances compared to CR, for the classification and follow-up of SpA.
Methods and Materials: Observational prospective single-center study, including SpA patients (definite diagnosis by expert opinion) and control patients [definite chronic mechanical low back pain (cLBP)]. All patients underwent pelvic and frontal and lateral CR of the entire spine, and 2D EOS imaging on the same day. Images were blindly assessed for sacroiliitis (modified New York criteria, mNY), and for ankylosis of the spine (modified Stoke Ankylosing Spondylitis Spinal Score, mSASSS). Global ease of interpretation was rated 0-10. The primary outcome was inter-modality agreement, with an a priori defined non-inferiority limit of 0.7. Inter-observer, intra-observer and inter-modality agreement were measured by kappa, weighted kappa, intra-class correlation coefficient, and Bland-Altman plots.
Results: 48 SpA patients [mean age 47.6 ± 14.9 years, symptom duration 21.4 ± 13.3 years, 35 (70%) men] and 48 cLBP controls (mean age 49.1 ± 10.7 years; 9 (22.5%) men] were included. Inter-modality agreement between EOS and CR was 0.50 (0.26-0.75) and 0.97 (0.95-0.98), for sacroiliitis and mSASSS, respectively. Ease of interpretation was greater for CR (8.2±0.9) as compared to EOS (7.2±0.8, $p < 0.0001$).
Conclusion: Our results suggest that EOS could replace CR for the classification and follow-up of the structural damage of the spine, but its place in the classification of sacroiliitis remains unclear.

B-0328 11:51

Reading of the sacroiliac joints on plain radiographs in undifferentiated spondyloarthropathies: agreement between local reading and trained central reading in a cohort of 708 patients

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Purpose: In daily practice, local radiologists/rheumatologist judge sacroiliac joints on X-rays (X-SI), while in cohorts the scoring is done by trained readers. Our aim was to compare the local scores to centralised scores.
Methods and Materials: Patients with back pain from the 25 participating centers were included in the DESIR cohort (*n*=708). Baseline X-SIs were scored by the local reader, according to a scoring method derived from the modified New York (mNY) criteria1 (local score). Grade 2 and 3 from the original mNY were pooled together in one combined grade 'DESIR-2'. Sacroiliitis was defined by at least unilateral grade ≥DESIR-2. In addition, two centralised readers independently scored all X-SIs according to the original mNY criteria. In case of disagreement, a radiologist experienced in SpA imaging served as adjudicator. An X-SI was marked positive for sacroiliitis if 2/3 readers agreed on bilateral ≥mNY-2 or unilateral ≥mNY-3.
Results: Inter-reader agreement between the two centralised readers was moderate (Kappa 0.54), while percentage agreement (84.3%) was good. However, the adjudicator needed to score 108/689 (15.7%) X-SIs because of disagreement among the two centralised readers. Overall, more radiographs were scored positive by the local readers (*n*=184) than by the centralised readers (*n*=145). In 77 patients, the X-SI was scored positive by the local reader but negative by the centralised readers.
Conclusion: Agreement between the centralised score and local score, also the inter-reader agreement between the two centralised readers, was moderate. The role of X-SI as diagnostic criterion for axial SpA should be re-evaluated.

10:30 - 12:00 **Room F2**

Breast

SS 502

Tomosynthesis, digital mammography and screening

Moderators:
L.A. Carbonaro; San Donato Milanese/IT
A. Evans; Dundee/UK

B-0329 10:30

Performance of one-view breast tomosynthesis versus two-view mammography in breast cancer screening: first results from the the Malmö breast tomosynthesis screening trial

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Purpose: The combination of 2-view BT and 2-view DM in breast cancer screening has been evaluated in three recent studies. The Malmö Breast Tomosynthesis Screening Trial (MBTST) was designed to assess the efficacy of 1-view BT versus 2-view DM in breast cancer screening. We now report preliminary results from the interim analysis of 7,500 screened women.
Methods and Materials: MBTST is a prospective, single-armed, paired study with a planned inclusion of 15,000 screening participants aged 40-74 years. In addition to the regular screening mammogram a 1-view BT with reduced compression is acquired with a Siemens Mammomat Inspiration unit. BT and DM images are read independently with double reading. BI-RADS ratings of 1-5 is reported and women with >= 3 are routinely recalled for work-up. Breast cancer detection rate, recall rate and other performance indicators will be presented.
Results: Sixty-five breast cancers were detected, 46 by both BT and DM, 18 only by BT and one only by DM. The detection rate with 1-view BT was 8.5/1000 women screened versus 6.3/1000 with 2-view DM. The recall rate after arbitration was 2.2% with 2-view DM versus 3.3% with 1 view-BT. Further refined data will be presented.
Conclusion: One-view BT alone increased breast cancer detection rate with approximately 40%. Our preliminary results suggests that 1-view BT as a single screening modality might be feasible.
Author Disclosures:
S. Zackrisson: Equipment Support Recipient; Siemens AG. Speaker; Speaker's fees and travel support from Siemens AG, Germany. **K. Lång:** Speaker; Speaker's fees and travel support from Siemens AG, Germany. **P. Timberg:** None. **I. Andersson:** Speaker; Speaker's fees and travel support from Siemens AG, Germany.

B-0330 10:39

Comparison of FFDM with DBT in a UK retrospective reading study

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Purpose: To compare digital breast tomosynthesis (DBT) with full field digital mammography (FFDM) in the UK NHS Breast Screening Programme.
Methods and Materials: Women recalled following screening were consented to have additional DBT imaging at the time of their assessment. We had DBT and FFDM reading data on 1087 women whose final diagnosis was cancer,

and 4514 whose final diagnosis was normal or benign. We had synthetic two-dimensional image (2D) reading data on 1032 cancers and 4137 non-cancers. Data was collected prospectively for each case. Histopathology from core biopsy or surgical excision was used as the gold standard to confirm cancer. The sensitivity and specificity of the different imaging combinations was compared in a retrospective reading study. Each case was read three ways (FFDM alone, FFDM with DBT and synthetic 2D image with DBT) by three different experienced screen readers who were not from the site where the case originated. Statistical analysis used McNemar methods.
Results: FFDM+ DBT showed a small but borderline significant (p=0.05) improvement in sensitivity over FFDM alone- 88% (955/1087) vs 85% (929/1087). FFDM+DBT showed substantially and significantly ($p < 0.001$) greater specificity than FFDM alone- 67% (3045/4514) vs 55% (2474/4514). No significant difference in sensitivity was noted for FFDM vs synthetic 2D plus DBT (p=0.9), but there was a highly significant difference in specificity- 67% (2774/4137)for synthetic 2D plus DBT vs 55% (2270/4137) for FFDM alone.
Conclusion: Digital breast tomosynthesis in combination with FFDM confers a substantial improvement in specificity, and may confer a small improvement in sensitivity.

B-0331 10:48

Added value of one-view breast tomosynthesis combined with digital mammography according to reader experience

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Purpose: To retrospectively evaluate the added value of one-view breast tomosynthesis when combined with mammography to characterise breast lesions.
Methods and Materials: One hundred fifty-five women (mean age, 51.3 years, range: 24-92 years) who systematically underwent mammography and breast tomosynthesis with subsequent percutaneous biopsy were analysed. Four radiologists (two seniors, R1 and R2, and two juniors, R3 and R4) independently reviewed exams in 2 steps: mammography alone and mammography with tomosynthesis. The lesions in the cohort included 39.3% (61/155) cancers and 60.6% (94/155) benign lesions.
Results: There was almost perfect agreement irrespective of reader experience for the reading of the combination of mammography and tomosynthesis, whereas agreement was poor between junior and senior readers for the reading of mammography alone. Area under the ROC (AUROC) values for the combination of mammography and tomosynthesis were significantly better than AUROC values for mammography alone for all readers except the most experienced, for whom only a tendency was noted. The proportion of cancers undiagnosed by mammography alone that were well diagnosed by the addition of breast tomosynthesis was 6.5% (4/61), 13.1% (8/61), 27.8% (17/61) and 26.2% (16/61) for Readers 1, 2, 3 and 4, respectively. The proportion of false positive cases induced by the addition of breast tomosynthesis to mammography was 2.1% (2/94), 2.1% (2/94), 9.5% (9/94) and 12.7% (12/94) for Readers 1, 2, 3 and 4, respectively.
Conclusion: Adding breast tomosynthesis to mammography improved sensitivity and negative predictive value for all readers except for the most experienced one.

B-0332 10:57

Digital mammography vs digital breast tomosynthesis in an enriched sample

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Purpose: To evaluate the sensitivity and specificity of digital mammography (DM) versus digital breast tomosynthesis (DBT) in an enriched sample.
Methods and Materials: A sample of 504 patients with both DM and DBT was retrospectively evaluated by two blinded experts. The mean age was 48.4 y/o (21-88). Only 32 (6.3%) showed ACR I density pattern and 230 (45.6%) had dense patterns (III & IV). Clinical and ultrasound studies were not available. The enriched sample included 61 cancers (12.1%) and 112 biopsy proven benign lesions (22.2%). The remaining 331 cases were normal or benign (1-year follow-up). COMBO mode (DM and DBT) was used. The patients were categorised as negative (BI-RADS cat 1&2) or positive (BI-RADS 3-5). Multifocal/multicentric were not considered. Data were analysed by using the SPSS (15.0) and PEPI softwares to calculate the concordance between the readers and to compare the sensitivity and specificity.
Results: The concordance between the readers for the BI-RADS classification was moderate for DM (kappa= 0.49) as well as for DBT (kappa=0.58). DBT significantly increased the sensitivity of both readers compared with DM alone (reader 1: DM 82%, DBT 95.1%; $p < 0.05$; Reader 2: DM 72.1%, DBT 80.3%; $p < 0.05$). Regarding the specificity, there were no significant differences for reader 1 (DM 69.5%, vs DBT 69.0%; $p > 0.05$) and for reader 2 (DM 67.6 % vs DBT 68.3%; $p > 0.05$).
Conclusion: The concordance between the readers was moderate in this enriched sample. DBT significantly increased the sensitivity of both readers but there were no significant changes regarding the specificity.

B-0333 11:06

First experience with the new generation low-dose digital breast tomosynthesis: can 2D synthetic image replace digital mammography in combination with digital breast tomosynthesis?

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Purpose: Digital breast tomosynthesis (DBT) is a new promising technique, expected to improve digital mammography (DM) interpretation by reducing tissue superimposition. DBT acquisition provides plane images focused at different depths of the breast. Moreover, synthetic 2D (2Dtomo) images analogue to DM images can be reconstructed. The aim of this study is to evaluate 2Dtomo associated with DBT, compared with DM associated with DBT in terms of added diagnostic value and dose received by the patient.
Methods and Materials: DBT was performed on 78 patients (symptomatic or screening-recalled) after DM examination with the new generation GE system (Senographe Essential). A total of 89 exams underwent double-blinded review by two experienced breast radiologists. The diagnosis was then confirmed by ultrasound, biopsy, magnetic resonance or contrast enhanced spectral mammography. For all exams, dosimetric information was also collected.
Results: Inter-observer accordance was in 90% of DBT images and 87% of 2Dtomo images. DBT findings were concordant with the final diagnosis in 98% of the cases and 2Dtomo in 73%. 2Dtomo is a synthetic image obtained processing the information of DBT without additional dose. The combination 2Dtomo/DBT would reduce the patient dose of about 50%. In addition, 2Dtomo improves the negative predictive factor (NPV). But this is only an apparent improvement, since 2Dtomo actually demonstrated really low sensitivity. Moreover, 2Dtomo significantly decreases the conspicuity of details compared with DM and DBT, independently from the final diagnosis and from breast density.
Conclusion: The combination of 2Dtomo plus DBT cannot, at present, replace DM in screening workflow.

B-0334 11:15

Improved detection of architectural distortion in digital mammography using distortion-weighted image (DiWI): a new mathematical image-filtering technique by the pinwheel-framelet processing method

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Purpose: To investigate the usefulness distortion-weighted image (DiWI) that is processed by the new pinwheel-framelet processing method specific to enhance architectural distortion in digital mammography.
Methods and Materials: The institutional review board approved the retrospective study. A total of 100 pairs of digital mammograms in CC and MLO views in half with and in half without architectural distortion were selected for the study. The diagnosis of a board-certified breast radiologist with 20 years experience was used as the gold standard. Original mammograms were processed to DiWI, a digitally-filtered image using the pinwheel-framelet processing method that is newly developed by our group based on the mathematical modelling of human visual processing. A board-certified breast radiologist (R1) who has 10 years experience and a radiology-resident (R2) who has 1 year experience of mammography assessed original digital mammograms with and without DiWI independently for the presence and the grades of distortion of mammogram. The result was assessed by area under curve (AUC) using receiver operating characteristic analysis.
Results: The AUC without DiWI by R1 and R2 were 0.96 and 0.81 and the AUC with DiWI were improved to 0.98 and 0.89, respectively The AUC by R1 was significantly lower than that by R2 ($p < 0.01$) but showed no significant difference with DiWI (p=0.25).
Conclusion: DiWI improved the diagnostic accuracy to assess architectural distortion of digital mammography, especially in less-experienced reader.

B-0335 11:24

Opportunistic breast cancer screening in the Netherlands

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Purpose: To compare the demand and indications for opportunistic breast cancer screening of women who are part of the target population of the Dutch organised programme (50-75) to women who are not invited for screening.
Methods and Materials: The study was conducted at the radiology department of the Academic Medical Centre, Amsterdam, The Netherlands. A total of 1,000 randomly selected women were included: 500 in the age group 40-49, and 500 in the age group 50-59. All included women were referred to the hospital by their general practitioner and received a mammographic examination between 1 January 2006 and 22 May 2011. Indications for referral

were retrieved from medical records. Based on these indications, mammographic examinations were classified into three groups: opportunistic screening, screening for women with increased familial risk and diagnostic examinations. The proportion of opportunistic screening was compared between both age groups using the Chi-squared test.
Results: There was no difference in the proportion of opportunistic screening in both age groups (28% versus 25% in the age groups 40-49 and 50-59, respectively; *p*=0.549). Screening for women with increased familial risk (8% versus 7%) and diagnostic examinations (65% versus 68%) showed similar results as well.
Conclusion: In contrast to our expectations, the proportional opportunistic screening in the age group not invited for screening was similar to that in the age group invited for screening. A linkage with the screening register could improve the assessment of opportunistic screening in the age group above 50.
Author Disclosures:
G.J. den Heeten: Advisory Board; former member of the medical advisory board of Matakina.

B-0336 11:33

Does a false positive recall for assessment deter women from subsequent breast screening?
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Purpose: Potential harms of breast screening include possible psychological morbidity of recall and workup for benign or normal outcome. We have evaluated the subsequent failure to attend screening as a surrogate for this potential adverse effect.
Methods and Materials: A cohort of 253,017 women screened in 5 geographically and demographically different centres within a national programme were studied. Subsequent re-attendance rates in those who received a normal result were compared with those who were recalled for assessment with normal or benign outcome. Data was extracted from the national database to assess effects of age, biopsy at workup and type of screen, prevalent or incident.
Results: Following a prevalent round screen, women were slightly but significantly more likely to re-attend after false positive recall than after a normal examination (87.7% vs. 86.0%; 95% CI: 0.54% to 2.62%). Following incident round screens overall re-attendance was higher than in prevalent rounds (92.4% vs. 86.2%), with no significant difference after false positive recall. However, women who underwent needle sampling or open biopsy were 12% and 60% less likely to re-attend than women with a normal screen ($p < 0.001$). Odds of re-attendance decreased significantly with increasing age.
Conclusion: This study suggests that any psychological morbidity resulting from breast screening assessment does not deter most women from subsequent attendance. Nevertheless invasive workup, particularly open biopsy but also percutaneous biopsy, does have a deleterious effect on re-attendance and should be used prudently.
Results from this study have been published online: J Med Screen, Aug 2013
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B-0337 11:42

Contralateral breast cancer: incidence according to ductal or lobular primary phenotype: a large dual cancer registry-based study
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Purpose: Historically there has been an association between invasive lobular carcinoma ILC and an increased risk of developing a contralateral breast carcinoma. We aimed to identify any differences in the incidence of contralateral breast cancer between patients with primary tumour diagnosis of invasive ductal carcinoma (IDC) and ILC.
Methods and Materials: Data from the Northern & Yorkshire Cancer Registry & Information Service (NYCRIS) and the West Midlands Cancer Intelligence Unit (WMCIU) from 1998 - 2003 for all registered cases of invasive breast cancer of either pure ductal or pure lobular reported histology were obtained. The invasive status of the contralateral tumour diagnosis and tumour morphology was collected. Chi-Square tests were undertaken to examine the differences in contralateral rates for both registries and univariate analysis to ascertain which predictors affected contralateral breast cancer risk in WMCIU.
Results: A total of 38132 patients were studied, 32735 (86%) with IDC and 5397 (14%) with ILC. There was no significant difference between the numbers of contralateral breast cancers according to original cancer histology, 901 (2·8%) patients with IDC vs 166 (3·1%) patients with ILC, p=0·169. The analysis of WMCIU cases showed no association between original histology, age at diagnosis, tumour grade, use of radiotherapy for the primary cancer or use of systemic therapy and development of a contralateral breast cancer.
Conclusion: There is no apparent increase in risk of developing a contralateral breast cancer according to the primary cancer histology either IDC or ILC.

B-0338 11:51

In the context of overdiagnosis, does size matter?
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Purpose: The Marmot review showed that although breast screening saves lives, it is harmful through overdiagnosis; treating cancers that would not otherwise have ever become clinically apparent. Currently, no size threshold exists for recalling screening patients with calcifications. Our aim was to assess whether a minimum size threshold would reduce overdiagnosis.
Methods and Materials: We conducted a retrospective review of 375 screening patients with microcalcifications over 24 months. We assessed all patients with pure calcifications ≤10 mm documenting core biopsy, final histology and treatment.
Results: 61 cases of microcalcifications ≤10 mm: 8 benign, 40 in situ cancers and 13 invasive cancers. This group was subcatagorised into calcifications: 0≤5 mm (24 patients) and 5≤10 mm (37 patients). In the '0≤5 mm' group, there were 16 in situ (low grade 1; intermediate grade 7; high grade 8) and 2 invasive cancers (G2 ductals ER/PR+Her2- node negative). In the '5≤10 mm' group, there were 24 in situ (low grade 3; intermediate grade 12; high grade 9) and 11 invasive cancers (4 G1ER+Her2- node negative; 6 G2: (5 ER+Her2-, 1 triple negative). 1 of these 6 cases was node positive (micrometastasis) and 1 G3ERPR+Her2- node negative). All underwent wide local excision, and all but one patient with invasive carcinoma received radiotherapy.
Conclusion: Recalling focal clusters of microcalcifications (< 10 mm) identified a high rate of cancers: 66%(40/61) in situ and 21% (13/61) invasive. Regarding overdiagnosis: 51% (27/53) of cancers were low/intermediate grade DCIS or G1 invasive and 49% (26/53) were high-grade DCIS or invasive G2/3. Therefore, size is not a key factor in reducing overdiagnosis.

10:30 - 12:00 **Room G/H**

Genitourinary

SS 507

Prostate cancer: diagnosis, extension and recurrence

Moderators:
T. Durmus; Berlin/DE
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B-0339 10:30

MR accuracy for the diagnosis of prostate cancer
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Purpose: To determine the accuracy of mp-MRI for prediction of extracapsular extension (ECE) in patients with prostate cancer (PCa) classified as "low risk".
Methods and Materials: Thirty-one patients with biopsy-proved PCa underwent endorectal MRI prior to radiation therapy. Histological features evaluated were Gleason score, affected lobe, greatest percentage of cancer in all core biopsy specimens, and percentage of cancer-positive core specimens in all core biopsy specimens. The likelihood of ECE was assessed retrospectively on the basis of MR five-points scale, where patients are divided into two groups, A and B (Group A MR score < 3; Group B MR score ≥3). Group B scores were considered suggestive for ECE. Pearson's chi-squared test and *t* Student were used to correlate histological and clinical data with MR parameters for ECE. All the statistics were developed in the environment of MATLAB® (Math Works, Inc). A difference with $P < .05$ was considered significant.
Results: In Group B serum PSA levels, percentage of cancer-positive core specimens in all core biopsy specimens, and ADC values were predictors of ECE ($P < .05$). There is a trend of correlation between ADC values and PSA levels (p=0.55); percentage of cancer-positive core specimens in all core biopsy specimens and greatest percentage of cancer in all core biopsy specimens (p=0.48); and ADC values and greatest percentage of cancer in all core biopsy specimens (p= 0.11).
Conclusion: Detection of locally advanced disease improved substantially when MRI was added to routine clinical staging; mp-MRI is able to assess ECE in 39% of cases in "low risk" PCa patients.

B-0340 10:39

The role of learning curves as a function of the expertise in the prostate MRI

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Purpose: To evaluate the changing of sensitivity in detecting prostate cancer (PC) assessing the learning curves with the advance of experience.
Methods and Materials: 900 patients who underwent a Mp-MRI examination of the prostate were independently retrospectively evaluated by 2 readers: reader A (R.A) and reader B (R.B).
Results: 170 patients out of 900 were originally assessed negative for the presence of PC. R.A in 69 out of 170 patients detected subsequently an altered focus and 2 further suspecious areas in 30 men, while R.B detected a suspecious lesion in 63 patients. 330 patients out of 900 in the first reading were considered positive for an altered focus: in the second reading R.A discovered a further area of suspiciuos malignancy in 157 patients, while R.B in 104 patients detected a further lesion. In 350 patients out of 900 initially were estimated two suspicious zones: in the second reading, R.A discovered a further zone of suspected malignancy in 180 patients, while R.B in 121 patients detected a further lesion. 50 patients originally were considered positive for 3 suspected areas: in the second reading session R.A discovered a further zone of suspected malignancy in 11 patients, while R.B in 5 patients. All in the sensitivity of R.A in detecting foci of morpho-functional changings increased from 61% to 97% and for R.B from 49% to 89%.
Conclusion: The sensitivity in detecting suspicious areas of PC increases substantially with the advance of the expertise reaching a detecting rate statistically significant ($P < 0.05$).

B-0341 10:48

Utility of exponential apparent diffusion coefficient for evaluating peripheral zone prostate cancer at 3 T: preliminary experience

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Purpose: To investigate the utility of exponential apparent diffusion coefficient (eADC) derived from diffusion-weighted imaging (DWI) in evaluating peripheral zone (PZ) prostate cancer at 3 T.
Methods and Materials: 74 patients who had PZ cancers of 0.5 cm^3 or greater on surgical specimens and performed DWI at 3 T were enrolled in this retrospective study. The eADC and ADC maps were obtained from DWI data, respectively. Based on radiologic-pathologic correlation, both eADC and ADC values ($\times 10^{-3}$ mm^2/s) for cancers and benign PZ tissues were measured by two independent radiologists, and the results were compared. Contrast-to-noise ratio (CNR) and signal-to-noise ratio (SNR) were measured on eADC and ADC maps. The correlation between eADC or ADC values of cancers and Gleason score was also assessed. Statistical analyses were performed using Wilcoxon signed rank test, intraclass coefficient (ICC), Bland-Altman test, and Spearman correlation analysis.
Results: The median eADC (0.48) and ADC (0.73) values of cancers were significantly different as compared with those of benign PZ (0.19 and 1.64, respectively) ($P < 0.001$). For cancers, eADC showed good interreader agreement (ICC= 0.758) and interreader variability of 1.1%. The SNR was significantly greater in eADC than ADC ($P < 0.001$), while the CNR was similar between eADC and ADC (P= 0.241). A moderate correlation between eADC (rho= 0.690) and ADC (rho= -0.694) of cancers and Gleason score was seen, respectively.
Conclusion: Our preliminary results suggest that eADC may be a useful imaging tool in evaluating PZ prostate cancers, with improved SNR compared with ADC.

B-0342 10:57

Preoperative MRI improves the surgical outcome in patients with non-palpable prostate cancer in a randomised study

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Purpose: The aim of this study was to evaluate whether MRI prior to prostatectomy improved the surgical outcome.
Methods and Materials: Prospective study including 411 patients randomised to MRI or not prior to prostatectomy (age: 63±8 years and PSA: 8.0±5.6 ng/ml). Gleason score in biopsy were 6: 34%, 7a: 38%), 7b: 11%, 8: 15%, and 9: 2%. Clinical T classification were: cT1: 54%, cT2: 43% and cT3: 3%. The MRI included high-resolution axial T2w images and DWI. Surgical excision was uni- or bilateral nerve sparing (UNS or BNS) or non- nerve sparing (NNS). Positive surgical margins (sm+) was defined as extension of tumor into the cut surface.
Results: The overall rate of sm+ (no MRI vs. MRI) was 23% vs. 20% (p=0.39). In cT1, the rate of sm+ was 27% vs. 16% (p=0.05). No difference was found in patients with cT2 and cT3. The sm+ rate according to the surgical procedure (no MRI vs. MRI); BNS: 19% vs. 12% (p=0.33), UNS: 21% vs. 19% (p= 0.74), NNS: 30% vs. 25% (p=0.57). In pT2 and pT3, the rate of sm+ (no MRI vs. MRI) was 8% vs. 5% (p=0.40) and 39% vs. 32% (p=0.36). In low, intermediate and high risk d'Amico groups, the rate of sm+ was 13% vs. 6% (p=0.32), 24% vs. 23% (p=0.90) and 32% vs. 30% (p=0.77).
Conclusion: Preoperative MRI reduces the risk of positive surgical margins after RALP in patients with non-palpable prostate cancer.

B-0343 11:06

Is there a role for functional MR techniques for the assessment of extracapsular extension in prostate cancer? A preliminary analysis with histopathologic correlation

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Purpose: The presence of extracapsular extension (ECE) has significant impact for treatment options in prostate cancer (PC). T2-w MRI-sequences are most commonly used for preoperative assessment of ECE, with variable accuracy. The aim is to evaluate the diagnostic accuracy of T2w-imaging vs. quantitative DWI-MRI (ADC) and DCE-MRI parameters (plasma flow (PF), mean transit time (MTT)) for detection of capsular invasion (CI) and ECE.
Methods and Materials: Triplanar T2w-sequences of 34 patients with PC were analysed prior prostatectomy by two blinded/experienced readers. DCE- and DWI-MRI were analysed by a third radiologist, in concordance to the histopathological analysis. Sensitivity (SS) and specificity (SP) of T2w, ADC, PF and MTT for prediction of CI/ECE were determined by area-under-the-receiver-operating characteristics analysis. ADC-, PF- and MTT-values were normalised by the PC/normal tissue ratio.
Results: By histopathologic analysis, 14/34 patients had ECE, 11/34 patients had only CI and 9/34 patients had no ECE/CI. The interobserver agreement for detection of ECE/CI of T2w-sequences was poor (κ=0.1), SS/SP for detecting ECE was 28/50%. PF-, MTT- and ADC-ratios in ECE differed significantly ($p < 0.001$) from cases without ECE. The AUC and SS/SP of ECE for PF-/MTT-/ADC-ratios was 0.98/92%/95%, 0.92/100%/80 and 0.69/86%/50%, respectively. PF- and MTT-ratios between CI and without CI/ECE differed significantly (PF, $p < 0.0001$; MTT, p=0.0134), SS/SP, 84%/89% for PF and SS/SP, 52%/100% for MTT-ratios, no significant differences regarding ADC-ratios could be identified.
Conclusion: ECE and CI can be assessed by quantitative DCE-MRI analysis with great diagnostic confidence. Moreover, quantitative PF- and MTT-values detect ECE/CI with greater specificity than ADC-value analysis.

B-0344 11:15

Usefulness of additional apparent diffusion coefficient (ADC) values to morphologic MR imaging in predicts extracapusular extension (ECE) of prostate cancer

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Purpose: In our previous study, we found that ADC values of prostate cancer with ECE are significantly lower than those of without ECE. The purpose of this study was to assess the predictive value for ECE of prostate cancer of MRI using morphologic (T2-weighted imaging [T2WI] and diffusion-weighted image [DWI]) alone and combined with ADC values.
Methods and Materials: This retrospective study included 230 patients who underwent 3.0-T MRI before total prostatectomy. We reviewed morphologic MRI and graded the likelihood of ECE on a five-point scale. ROIs were placed in the dominant cancerous area.ADC values were calculated by at least square (b=0, 800, 1500).We consider the possibility of ECE is higher when the ADC values were lower, but it limited to the auxiliary role of the morphologic MRI. We graded the likelihood of ECE on a five-point scale using additional ADC values to morphologic MRI. Diagnostic performance (area under receiver operating characteristic [ROC] curve: AUC), accuracy, sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were evaluated.
Results: AUC improved significantly after additional ADC values; AUC=0.8044 (MRI alone), AUC=0.8494 (MRI+ADC value), (p=0.0003). Morphologic MRI alone showed accuracy, sensitivity, specificity, PPV, and NPV of 73.5%, 68.0%, 77.4%, 68.6% and 76.9%, respectively. Additional ADC values showed accuracy, sensitivity, specificity, PPV, and NPV of 79.1, 73.2%, 83.5%, 76.3% and 81.0%, respectively.
Conclusion: Additional ADC values to morphologic MR imaging improve the predictive value of ECE of prostate cancer.

B-0345 11:24

3 T diffusion tensor imaging (DTI) in the evaluation of periprostatic nerve bundle before and after radiation therapy

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Purpose: To assess diffusion tensor imaging (DTI) at 3 T for evaluating the periprostatic nerve bundle in terms of neuranatomical distribution, density and relationship with the capsule before and after radiation therapy (RT).
Methods and Materials: 63 patients were enrolled. All underwent a multiparametric-MRI examination of the prostate at 3 T magnet (Discovery M750, GE) equipped with an endorectal and a surface coil, before and after 2 months of radiation treatment (35 cycles). Scan protocol included: a morphological study obtained with TSE high-resolution T2-weighted sequences on multiple plans, a dynamic study with contrast medium for localisation of the lesion, a diffusion study (DWI) with different b values (500.1000,3000) and DTI technique (fiber tracking) using a b value of 1000 with 16 directions.
Results: In all cases, before RT it has been possible to display the periprostatic nerve bundle in terms of anatomical distribution, density and distance of the nerve fibers from the capsule; after RT we observed, respectively, superposition of the findings in 27 patients, partial integrity of the fibers in 31 patients (loss of nerve fibers ranging from 19% to 35%, mean 26.3%) and massive rarefaction of the nerve fibers in 5 patients (loss of nerve fibers ranging from 42% to 59%, mean 47.8%). These results compared with the IIEF-5 test showed a statistically significative correlation ($p < 0.05$).
Conclusion: DTI technique allows a complete visualisation of the periprostatic nerve bundle and plays an important role in the evaluation of nerve fibers damage in patients who underwent RT.

B-0346 11:33

Preoperative lymph node staging in patients with primary prostate cancer using diffusion-weighted magnetic resonance imaging and [11C] choline PET/CT: which method is better?

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Purpose: Lymph node staging in primary prostate carcinoma using conventional Magnetic Resonance Imaging (MRI) and Computer Tomography (CT) relies on size measurements, in overall exhibiting low sensitivity and specificity. New promising techniques including diffusion weighted imaging (DWI) and [11C]choline PET/CT can give additional functional information. The aim of this study was to compare diagnostic performance of DWI and [11C]choline PET/CT in the assessment of preoperative lymph node status in patients with primary prostate cancer.
Methods and Materials: 33 patients with primary prostate carcinoma underwent DWI and [11C]choline PET/CT prior to radical prostatectomy and extended pelvic lymph node dissection. Functional parameters including maximum standardised uptake value (SUVmax) and apparent diffusion coefficient (ADC) of identified lymph nodes were measured and correlated with histopathology. Performance of both modalities was compared by calculation of receiver operator characteristic (ROC) curve using histopathology as standard of reference.
Results: A significant difference between malignant and benign lymph nodes was observed for mean ADC (1.16 vs. 0.93 mm2/s) and SUVmax (1.95 vs. 4.31). ROC curve analysis revealed optimal ADC threshold of 1.01 mm2/s for differentiating benign form malignant lymph nodes with a corresponding sensitivity/ specificity of 77.41%/ 77.05% and an Area under the Curve (AUC) of 0.810. The optimal threshold for SUVmax was 2.66 with corresponding sensitivity/ specificity of 74.19%/ 80.49% and an AUC of 0.819.
Conclusion: DWI and [11C]choline PET/CT reveal a similar diagnostic performance for pre-operative lymph-node staging of prostate cancer.

B-0347 11:42

Discrimination of benign and malignant lymph nodes in prostate cancer: diameter measurement vs DWI, ADC mapping or signal intensity at T2w-STIR?

M. Regier, C. Seiwerts, F.O. Henes, H. Kooijman, G. Sauter, G. Adam, L. Budaeus; *Hamburg/DE (mregier@uke.de)*

Purpose: To determine the accuracy of quantitative MRI using diffusion-weighted MRI (DWI) and signal intensity measurement at T2w STIR in prostate cancer to compare these to histopathology.
Methods and Materials: 59 consecutive patients at high-risk following D´Amico criteria underwent pelvic MRI one day before prostatectomy. A standardised T2w STIR and DWI sequence were applied (b-values: 0.25.75,100,200,500 and 900). Short (SAD) and long axis diameters (LAD) and mean and maximum signal intensity of pelvic nodes were recorded at T2w STIR. ADC calculation was performed and mean (ADCmean) and minimum ADCs (ADCmin) were determined. 1393 lymph nodes were removed and histopathologic workup was performed. Sensitivity, specificity, positive- and negative-predicitve-values for the discrimination of benign and malignant nodes were calculated using Wilcoxon and chi-square test.
Results: Histopathology revealed malignant nodes in 21 patients. In these nodes, the mean SAD and LAD were 8.3 mm (range, 3-14.2 mm) and 12.3 mm (range 4-27 mm). Applying a threshold of 0.98x10-3 mm2/s for the ADCmean only 2 false positive findings were noted. The ADCmin was the most accurate discriminator allowing for correct identification of malignant nodes in all patients with 100% specificty if a threshold of 0.74x10-3 mm2/s was applied. Determination of mean (p=0.62) and maximum (p=0.07) signal intensities at T2w STIR did not proof any statistical significance for the discrimination of nodes.
Conclusion: Although the sensitivity rates of diameter measurement and DWI were equivalent, assessment of the ADCmin proofed to be the superior discriminator with an accuracy of 100%. Signal intensity measurements at T2w STIR have limited capability of detecting malignancy.

B-0348 11:51

The role of combined 3 T DWI with MRS in the differentiation of loco-regional recurrence from residual glandular tissue after radical prostatectomy

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Purpose: To distinguish between loco-regional recurrence and residual glandular healthy tissue using 3 T DWI and MRS after radical prostatectomy (PR).
Methods and Materials: 60 patients who underwent RP with persistence of minimum PSA values or modest rise of PSA values within 6 months (range between 0.2 ng/ml and 1.5 ng/ml) were enrolled for 3 T multiparametric-MRI examination. The protocol included: a morphological study with high-resolution T2-weighted sequences, a dynamic study with T1-weighted GRE sequences acquired after intravenous administration of contrast medium, a diffusion-weighted (DWI) study with exponential b-values (0, 500, 1000, 3000) and three-dimensional multivoxel spectroscopic sequence (MRS). Each patient was evaluated independently by two radiologists. MRI results were validated by transrectal ultrasound biopsy.
Results: In all cases, a solid tissue (size between 8 mm and 23 mm) was identified in T2 morphological images. In 49 patients (81%) DWI and MRSI demonstrated features of malignancy (ADC values ranging from 0.3 to 1.1 mm2/s and a choline-plus-creatine-to-citrate ratio CC/C in at least 3 adjacent voxels > 0.8. In the remaining 11 patients (19%) DWI and MRS showed benign features (ADC values > 1.2 mm2/s and a CC/C in at least 3 adjacent voxels < 0.5. All MRI findings were confirmed by histological **Results:** 39 patients had loco-regional recurrence and 11 patients had residual glandular tissue.
Conclusion: The combination of DWI and MRS is proved to be a very reliable tool for distinguish beetween loco-regional recurrence and residual glandular tissue after RP.

10:30 - 12:00 **Room I/K**

Neuro

SS 511

Paediatric neuroimaging and developmental anomalies

Moderators:
V. Mendes Pereira; Geneva/CH
A. Rovira-Cañellas; Barcelona/ES

B-0349 10:30

High-resolution MRI using orbit surface coils vs conventional MRI in the evaluation of metastatic risk factors in children with retinoblastoma

S. Sirin, M. Schlamann, K.A. Metz, N. Bornfeld, M. Holdt, B. Schweiger, F. Nensa, P. Temming, S.L. Goericke; *Essen/DE (selma.sirin@uk-essen.de)*

Purpose: Conventional MRI is a well-accepted, non-invasive imaging modality for the evaluation of tumor extension in children with retinoblastoma. First studies using high-resolution MRI with orbit surface coils were promising. The aim of this study therefore was to assess if high-resolution MRI using orbit surface coils is superior to conventional MRI regarding the depiction of metastatic risk factors in children with retinoblastoma.
Methods and Materials: 66 children (25 female, 41 male, mean age 18.9 months, 67 enrolled eyes) underwent conventional MRI using a standard head coil on 1.5 T. After the administration of Gadolinium additional high-resolution T1-weighted sequences were acquired with orbit surface coils. Two reviewers evaluated both Gadolinium-enhanced T1-weighted sequences regarding the presence of metastatic risk factors (postlaminar optic nerve infiltration,

choroidal invasion, orbital fat invasion). Histopathologic evaluation after enucleation served as reference standard.
Results: Depiction of metastatic risk factors increased with high-resolution MRI using orbit surface coils: Sensitivity and specificity for the detection of postlaminar optic nerve infiltration were 70.0%/87.7% with high-resolution MRI using orbit surface coils and 40.0%/86.0% using conventional MRI. High-resolution MRI using orbit surface coils additionally increased the detection rate of choroidal invasion (sensitivity/specificity 73.7%/93.8% vs. 31.6%/93.8%). There was one patient with orbital fat invasion in the patient group, which was only detected in the images acquired with the orbit surface coil.
Conclusion: High-resolution MRI using orbit surface coils is superior to conventional MRI using a standard head coil for the evaluation of metastatic risk factors in children with retinoblastoma.

B-0350 10:39

"White matter choking signs" for diagnosis of focal cortical dysplasia on 3 T MR imaging: retrospective analysis of 165 cases with multi-modality metabolic imaging and radio pathological correlation
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Purpose: To describe two new signs called "White Matter Choking Sign" and "WM Choking extended" useful for diagnosis of FCD.
Methods and Materials: 165 patients in age group of 6-44 years with refractory epilepsy were included in the retrospective study imaged using Both TLE and ETLE (extra temporal lobe epilepsy) protocols on a 3 T MRI system (Achieva ,Philips Health care, Netherlands) with a 3D T1, 3D T2, 3D T2 FLAIR for detection of occult dysplasia. The data was viewed and post-processed using a Philips Portal Work station and Advantage Windows (GE health care system) to generate 3D corticographs of normal, abnormal areas and correlated with multimodal imaging and pathology.
Results: Three patterns emerged in our series of histopathologically proved FCD. The FCDS analysed were as follows: 1B (56), IIA (33), IIB (27), III (39). Sudden truncation or choking of sub-cortical white matter with blurring of interface (White Matter Choking sign) has positively correlated with Focal cortical dysplasia in 82%, WM choking sign underlying a cortical laminar architectural abnormality (White Matter choking Extended sign) has positively correlated with type IB and Type IIA- 92%, abnormal Medullary Spike Pattern was seen in Cingulate gyral FCD (n=4), Para sagittal Cortical Ribbon dysplasia of type IB (n=7). Type 1B and IIA: sensitivity 92%, specificity 81%, Type IIB sensitivity 92%, specificity 70%; specificity of type IIB improved with presence of trans mantel sign (n=27) to 95%.
Conclusion: White Matter Choking Sign and White Matter choking Extended sign offer optimal sensitivity and specificity for MRI detection of FCD.

B-0351 10:48

Isolated craniosynostoses: is cranial sutures ultrasonography helpful?
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Purpose: The aim of this study is to demonstrate the effectiveness of the use of ultrasound as a diagnostic and follow-up tool in newborn children affected by craniostenoses.
Methods and Materials: Between May 2011 and July 2012, 23 children aged between 1 month and 8 months were referred to our operative unit for abnormal head shape or small head diameter. We selected 17 children, whose clinical findings were clinically suggestive for craniostenosis or head molding. All patients underwent an ultrasound examination and, those positive for craniostenosis or with an uncertain diagnosis also underwent CT scan examination; US scan and CT scan were performed within one week from clinical examination.
Results: Five infants had normal appearance of the cranial sutures on US. In 12/17 infants, US identified premature closure of one or more cranial sutures. In one case, US was not able to determine the real closure of right coronal suture and a six months follow-up was needed.
Conclusion: In our experience ultrasound examination has shown to be an effective, fast, inexpensive and nonrisky method for diagnosis and assessments in children with craniostenoses, and was able to detect the presence of synostosis in all patients affected with a 100% match with CT scan examination.

B-0352 10:57

Prenatal detection of abnormal hippocampal development in lissencephaly
B. Kunzendorf, E. Schwartz, G. Langs, D. Prayer, G. Kasprian; *Vienna/AT (n0742368@students.meduniwien.ac.at)*

Purpose: To detect and quantify differences in the hippocampal morphology between normal foetuses and cases with lissencephaly.
Methods and Materials: Standardised coronal T2-weighted foetal MR (1.5 Tesla) sequences of 19 cases with the neuropathological/follow-up imaging diagnosis of lissencephaly were compared to 36 normal foetuses (age range 20-39 gestational weeks - GW). The boundaries of the hippocampi were segmented using ITK Snap in order to define 4 lines, using 4 characteristic hippocampal landmarks and 3D Slicer. 4 angles between these lines were measured. A midline served as a reference to assess the positioning of the hippocampus as a whole.
Results: Normal age-related reduction of hippocampal angles (r^2=0.387;.000) could not be observed in lissencephaly cases (r^2=.010;.674). In lissencephaly, the angles were significantly wider than in normal age matched controls (p=.000; Welch's Test). Only two angles were sufficient to discriminate healthy from lissencephaly fetuses with a sensitivity of 80% and a specificity of 94.4%. Normals showed left/right differences in one angle (p=0.009; paired t-test), whereas in lissencephaly cases, 3 angles were asymmetric (p=.031;.021;.045; paired t-test). The rotation of the main axis from vertical to horizontal was less pronounced in lissencephaly on the right side (p=.005; Welch's Test).
Conclusion: Geometrical 2D analysis provides insights into normal and abnormal patterns of prenatal hippocampal morphology and adds valuable quantitative data to detect and characterise fetal brain pathologies. Interhemispheric differences have to be taken into account.

B-0353 11:06

Foetal cortical pattern analysis in commissural dysgenesis
G. Kasprian, E. Schwartz, G. Langs, P. Brugger, D. Prayer; *Vienna/AT (gregor.kasprian@meduniwien.ac.at)*

Purpose: To detect and describe abnormalities and differences in cortical folding patterns of foetuses with commissural dysgenesis (CD).
Methods and Materials: Three orthogonal T2-w sequences (1.5 Tesla, slice thickness 4.4 mm, FOV 230 mm, TE=140 ms) of 12 foetuses with isolated, partial and associated forms of CD were retrospectively analysed. 2D pattern analysis consisted of cortical contour delineation (coronal plane) and 2D shape modelling using a multivariate Gaussian model. For 3D modelling axial, coronal and sagittal sequences were combined into isotropic volumes (resolution 0.78-1.02 mm) using intra-slice motion correction and super-resolution reconstruction. In these, the shape of the manually delineated cortical contour was described using a 3D Gaussian model. Results were compared to 12 age-matched foetuses with normal cerebral development.
Results: Hemispheric asymmetry patterns are less pronounced in the acallosal group of foetuses as demonstrated by 2D pattern analysis. Hemispheric asymmetries were less pronounced in the perisylvian brain regions in CD cases. 3D modelling could readily visualise the dynamic cortical folding patterns in CD foetuses and could detect sublte differences to normal controls.
Conclusion: 2D and 3D modelling and pattern analysis are computerised, quantitative methods to detect even subtle differences of atypical cortical folding patterns of foetuses with CD. In future, these tools may be further suitable to differentiate cases of isolated CD with adverse neurodevelopmental outcome from those with close to normal development.

B-0354 11:15

Unexpected brain MRI findings in research volunteers
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Purpose: Brain MRI scans performed in neuroscience studies have revealed a range of unexpected findings in normal volunteers. The incidence and types of abnormalities have not been well established in a large population, and best practice for dealing with such findings is controversial. We undertook this study to analyse abnormalities discovered by expert MRI readers in a large group of children and adult research volunteers.
Methods and Materials: 6441 consecutive subjects (< 1 to 94 years) were recruited from a single institution, referred from over 100 IRB-approved brain research studies. All scans were uploaded to PACS and interpreted by Neuroradiologists using an on-line structured report. Research technologists and staff were also prospectively asked to document concerns discovered while scanning or processing.
Results: On formal neuroradiologic review, normal results were found in 5205/6441 (80.8%). Among 1236 abnormals, 982/6441 (15.2%) were categorised as follow-up not mandatory; and in 254/6441 (3.9%) follow-up was recommended. Less than 1% of the abnormalities were prospectively correctly flagged by research staff. No correlations were established between abnormal results and either gender or age. When volunteers were contacted regarding abnormal findings, they were almost universally grateful for the information, and opted for additional clinical evaluation.
Conclusion: Potentially clinically significant abnormalities are seen in nearly 4% of children and adults who volunteer for research brain MRI scans, and these are only rarely accurately identified by research staff. Routine expert Radiologic review of all such scans can help facilitate clinical referral when indicated.
Author Disclosures:
H. Rowley: Consultant; GE, Bracco, Guerbet, Gore, Genentech, and Lundbeck.

B-0355 11:24

Normal variations of the falx cerebri shape based on MR data

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Purpose: Evaluation of the normal variations of falx cerebri shape based on MR data.
Methods and Materials: We retrospectively reviewed 2313 consecutive brain MR exams done in 2012. Falx cerbri and supratentorial compartment were manually traced on the mid-sagittal contrast-enhanced T1WI. The falx shape was assessed by evaluation of falx height and area. Falx height was measured from the highest point at its inferior edge to a reference line (RL) drawn from junction of the inferior sagittal and straight sinuses to crista galli. Falx area was measured in reference to the entire supratentorial compartment area. Statistical analysis was performed using ANOVA and Chi-square test.
Results: 170 exams satisfied our inclusion criteria (adults with exams including contrast-enhanced sagittal T1WIs of slice thickness 1.5 mm or less). We identified three falx shapes. Type-I with D/RL ratio less than 0.33, type-II with ratio (0.33 - 0.67), and type-III with ratio more than 0.67. These types were seen in 3%, 68%, and 29% of the cases, respectively. There was significant difference in the height between the three types (p=0.025). No significant difference was observed in the absolute falx area (p=0.592), however, a significant difference in the percentage of falx area to the entire supratentorial compartment area (p=0.019) was noted.
Conclusion: Falx cerbri shape can be clustered into 3 types. The percentage of falx area to the entire supratentorial compartment area is different in these types. This finding may guide future studies to develop a biomarker of subfalcine herniation risk depending on the falx shape type.

B-0356 11:33

Modality specific activations in working memory in children treated for cerebellar medullobastoma: an fMRI study

D. Hoang, A. Pagnier, E. Cousin, K. Guichardet, I. Schiff, F. Dubois-Teklali, A. Krainik; *Grenoble/FR (hoang_ducha@yahoo.fr)*

Purpose: Children treated for a cerebellar medulloblastoma demonstrated cognitive disorders in working memory (WM), especially visuospatial WM, leading to an impairment of school performance. The purpose of recent study is to describe the cerebellar involvement in specific cognitive deficits observed in these children.
Methods and Materials: Nine healthy volunteers children (11.1± 2.2 yo), were compared to 5 patients treated for cerebellar medulloblastoma (12.1±0.6 yo). All subjects were native French speakers, right-handed, with a global IQ of 70-130. The participants were examined through 4 block-design 1-back tasks in the sensorial modality (visual/auditory) and the nature of the cues (verbal/nonverbal), using BOLD fMRI. Data was analysed by ANOVA with 2x2 factorial design, using SPM8 and SUIT (spatially unbiased infra-tentorial and cerebellar template).
Results: 4/5 patients had a WM deficit following a resection of the left posterior cerebellar lobe (CrusI/II, lobule VIIb/VIII/IX) and inferior part of vermis; the only patient without WM deficit was the only one without this region resection. BOLD activations for visual vs. auditory and nonverbal vs. verbal contrast were found in the left posterior cerebellar lobe of healthy subject group.
Conclusion: The cerebellum plays the same role in WM in children as that has been previously described in adults. The left posterior cerebellar lobe may involve the visuospatial WM.

B-0357 11:42

Value of DSA in the diagnostic workup of pulsatile tinnitus

C. Deuschl, S. Göricke, G. Lehnerdt, O. Kastrup, O. Müller, M. Forsting, M. Schlamann; *Essen/DE (cornelius.deuschl@uk-essen.de)*

Purpose: Pulsatile tinnitus is a rare complaint, which can be a symptom of several pathologies, e.g. dural arteriovenous fistula (DAVF), arteriovenous malformation (AVM), intracranial stenosis or glomus tympanicum paraganglioma. The current diagnostic pathway includes an extensive neurological examination, cranial MRI and diagnostic digital subtraction angiography (DSA) as gold standard in imaging. This retrospective study evaluates the additional diagnostic impact of DSA for diagnostic workup in comparison to MRI.
Methods and Materials: Fifty-four consecutive patients with pulsatile tinnitus treated in our institution between 2002 and 2013 were included in this retrospective study. All patients had a diagnostic workup including DSA and cerebral MRI. MRI examinations were blinded for DSA results and retrospective analysed by two experienced neuroradiologists (> 10y) in consensus. All MRI sequences were analysed separately.
Results: DSA revealed pathologic findings in 37 of the 54 patients. 26 patients had DAVF, two patients had AVM, two patients a galeal AV fistula, four patients glomus tympanicum paraganglioma, two patients carotid-sinus-cavernosus-fistula and three patients had other pathologies. All pathologies, which caused the pulsatile tinnitus were detected by MR imaging.
Conclusion: In our study DSA revealed no further information in patients without any detectable MRI pathology. We suggest that cranial MRI-protocol should contain a time-of-flight-angiography (fistula, stenosis), a contrast-enhanced-angiography of the supraaortal vessels (fistula, stenosis), a fat-saturated, contrast-enhanced T1-weighted sequence of the skull base (paraganglioma) and a T2-weighted sequence (fistula, paraganglioma). DSA is only recommended when MRI is suspicious for pathology. For the grading of fistula DSA is still mandatory.

B-0358 11:51

Postmortal developing of ADC measured with ex vivo DWI of the brain: a comparison study of in vivo and ex vivo

J. Yamamura[1], S. Keller[1], B. Schönnagel[1], T.M. Schmidt[1], R. Fischer[2]; [1]*Hamburg/DE*, [2]*Oakland, CA/US (s.keller@uke.de)*

Purpose: Changes in water diffusion can be quantified by diffusion-weighted MR imaging; for example, to diagnose ischemic stroke. However, there are only few works about changes in post-mortem brain. The aim of this study was to examine for a typical developing of ADC after death and to compare the values to in vivo brain.
Methods and Materials: 21 corpses were scanned (13 male, 8 female). Mean age was 75.5 ± 0.7 years and mean weight 74.2 ± 18.3 kg. All died a natural cause of death. They were scanned with a 1.5 T MRT (Siemens Magnetom Symphony; Erlangen, Germany). Scans were repeated in time lags of 1 h. Diffusion-weighted imaging (DWI) was performed with *b* values of 0 and 100. An ADC-mapping was calculated in thalamus, cerebrum and cerebellum. The so-obtained values were then statistically compared to healthy volunteer (n=5) and to the literature. Student t test was performed for statistical analyses.
Results: The ADC in the three examined regions (cerebrum, cerebellum, thalamus) decreased during the examination in a characteristical way. The allocation of ADC values between ex vivo and in vivo is significantly different and can be described by a Gaussian distribution ($p < 0.005$).
Conclusion: Ex vivo ADC values are significantly different to the in vivo literature values. Post-mortem DWI of the brain may be able to help to assess the time of death.

10:30 - 12:00 **Room L/M**

Abdominal Viscera

SS 501

MRI of diffuse liver disease

Moderators:
T. Denecke; Berlin/DE
N. Papanikolaou; Iraklion/GR

B-0359 10:30

Intravoxel incoherent motion diffusion-weighted imaging for staging hepatic fibrosis

S. Ichikawa, U. Motosugi, H. Morisaka, K. Sano, T. Ichikawa; *Chuo-shi, Yamanashi/JP*

Purpose: To investigate the relationships between the degree of hepatic fibrosis and parameters calculated using intravoxel incoherent motion (IVIM) imaging of the liver.
Methods and Materials: We included 100 patients, divided into 3 groups: group A, without hepatic fibrosis (n=41); group B, with chronic liver disease (F1-F3) (n=20); group C, with cirrhosis (n=39). IVIM imaging was used to acquire diffusion-weighted images at 11 b values (0, 10, 20, 30, 40, 50, 80, 100, 200, 500, and 1000 s/mm^2). The diffusion coefficient of pure molecular diffusion (D), diffusion coefficient of microcirculation or perfusion-related diffusion (D*), perfusion-related diffusion fraction (f), and apparent diffusion coefficient (ADC) were compared among the 3 groups. Receiver operating characteristic curve analysis was also performed to determine the optimal cut-off value and accuracy of IVIM and MR elastography (MRE) for staging hepatic fibrosis.
Results: Only mean D* value was significantly different amongst the 3 groups (group A, 76.0 × 10^{-3} mm^2/s; group B, 64.2 × 10^{-3} mm^2/s; group C, 57.9 × 10^{-3} mm^2/s; $P < 0.0001$). There were no significant differences in the D ($P = 1.0000$), f ($P = 0.1563$), and ADC values ($P = 0.3435$). The Az values for diagnosing the degree of hepatic fibrosis were as follows (D* value vs. MRE): ≥group B, 0.9649 vs. 0.9801 ($p = 0.3741$); ≥group C, 0.9606 vs. 0.9871 ($P = 0.1765$).
Conclusion: As hepatic fibrosis progresses, the hepatic perfusion reduced, and was effectively detected by IVIM imaging. IVIM is reliable technique for evaluating hepatic fibrosis as well as MRE.

B-0360 10:39

Utility of hepatobiliary phase in the Gd-EOB-DTPA-enhanced MR imaging in the differentiation of simple steatosis and nonalcoholic steatohepatitis.

M. Takechi, T. Tsuda, G. Koiwahara, H. Tanaka, T. Mochizuki; *Ehime/JP*

Purpose: To evaluate the utility of hepatobiliary phase in the gadolinium ethoxybenzyl diethylenetriaminepentaacetic acid-enhanced MR imaging (EOB-MRI) in differentiating SS (simple steatosis) from NASH (nonalcoholic steatohepatitis).
Methods and Materials: From August 2009 to March 2013, histologically proven 27 patients (11 SS and 16 NASH) who underwent both EOB-MRI and in-phase/out-of-phase imaging were enrolled. The liver-to-spleen contrast ratio (L/S ratio = signal intensity of the hepatic parenchyma/signal intensity of the spleen) and liver-to-muscle signal intensity ratio (LMSIR = signal intensity of the hepatic parenchyma / signal intensity of the paraspinal muscle) were calculated in the hepatobiliary phase of EOB-MRI, signal intensity loss on out-of-phase T1-weighted images (fat fraction), which were compared between SS and NASH groups. The correlations between histological stage/grade and L/S ratio or LMSIR were explored.
Results: The L/S ratio and LMSIR in NASH were significantly lower than those in SS ($p = 0.01$, 0.008). There was no difference in fat fraction between SS and NASH groups ($p = 0.767$). In SS and NASH groups, the L/S ratio ($r = -0.515$, $p = 0.007$) and LMSIR ($r = -0.476$, $p = 0.014$) were significantly correlated with the fibrosis stage. Fat fraction in NASH was strongly correlated with the steatosis score ($p < 0.0001$, $r = 0.876$).
Conclusion: In SS and NASH groups, the L/S ratio and LMSIR in the hepatobiliary phase of EOB-MRI were useful imaging markers to differentiate SS from NASH, showing significant association with fibrosis stage.

B-0361 10:48

Effect of extended delay time on the degree of liver enhancement on Gd-EOB-DTPA-enhanced MRI in patients with parenchymal liver disease

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Purpose: To compare hepatic parenchymal enhancement on the hepatobiliary phase (HBP) obtained at 20 vs 30 minutes delay in patients with parenchymal liver disease (PLD).
Methods and Materials: This retrospective study included subjects with PLD who underwent Gd-EOB-DTPA-enhanced MRI of abdomen from May until August 2013, where HBP was obtained at both 20 and 30 minutes delay. For each case, presence of biliary opacification with Gd-EOB-DTPA and signal intensity (SI) of the liver, main portal vein (PV) and spleen were recorded on pre-contrast, 20 and 30 minutes HBP. The following indices were calculated for both 20 and 30 minutes HBP: liver relative enhancement (LRE) = $(SI_{HBP} - SI_{pre})/SI_{pre}$, liver/spleen index (LSI) = $(SI_{liver}/SI_{spleen})_{HBP}/(SI_{liver}/SI_{spleen})_{pre}$, liver/PV index (LPI) = $(SI_{liver}/SI_{PV})_{HBP}/(SI_{liver}/SI_{PV})_{pre}$.
Results: There were 64 subjects, 34 (53.1%) men, mean age 58.8 years (±11.7), median MELD score 40.9 (IQR 9.0 - 44.9). Biliary opacification was present in 56 (87.5%) of 64 subjects on 20 minutes HBP and in 62 (96.9%) of 64 subjects on 30 minutes HBP ($p < 0.05$). Mean LRE were 0.46 (±0.3) at 20 minutes and 0.48 (±0.3) at 30 minutes, $p < 0.03$. Mean LSI were 1.27 (±0.3) at 20 minutes and 1.35 (±0.4) at 30 minutes, $p < 0.0001$. Mean LPI were 1.11 (±0.4) at 20 minutes and 1.18 (±0.4) at 30 minutes, $p < 0.0001$.
Conclusion: Extending delay time of HBP to 30 minutes improves degree of liver enhancement and rate of biliary opacification in patients with PLD.

B-0363 10:57

Success rate of three MRI protocols for liver iron measurements

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Purpose: Several MRI-methods with particular benefits and drawbacks are in use for measuring liver iron concentration (LIC). Examples include MR-relaxometry (R2 and R2*) and the Gandon-method. We assessed the success rate of these three methods.
Methods and Materials: All patients undergoing LIC-measurements in our centre between January 2008 and December 2012 were retrospectively included. LIC-measurements consisted of the Gandon-, R2- and R2*-methods. Regions-of-interest were drawn by one observer. R2 and R2* were calculated using bi- and monoexponential signal decay functions, respectively. Rician noise bias was approximated by the pythagorean addition of an extra fit parameter to these functions. Gandon-data were converted online to a LIC-value in µmol/g, which has an upper detection limit of 340 µmol/g. All iron levels above this limit are given as > 350 µmol/g. The relationships between methods were assessed with Spearman's correlation coefficient (r_s).
Results: A total of 122 LIC-measurements were performed in 99 patients. Gandon-, R2*- and R2-data were successfully acquired in 90/99 (91%), 98/99 (99%) and 59/99 (60%) baseline measurements, respectively. Correlations r_s between Gandon-R2*, Gandon-R2 and R2*-R2 for LIC< 350 µmol/g were near perfect at 0.97 ($P < 0.001$, n=77), 0.88 ($P < 0.001$, n=47) and 0.91 ($P < 0.001$, n=51), respectively. LIC was > 350 µmol/g in 14 subjects. For these R2* and R2 correlated at r_s=0.73 (P=0.04, n=8).
Conclusion: Our data suggest that the Gandon- and R2*-methods are preferable over the R2-method for LIC-measurement in terms of success rate. Given that R2* is also sensitive for iron detection in subjects with LIC> 350 µmol/g, R2* seems the method of choice.

B-0364 11:06

The role of iron in elevation of liver enzyme levels in steatosis: a non-invasive assessment in general population by magnetic resonance imaging

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Purpose: To investigate whether hepatic iron content can affect liver enzyme levels in subjects with non-alcoholic fatty liver disease (NAFLD) and non-alcoholic steatohepatitis (NASH) using non-invasive assessment by MRI.
Methods and Materials: The study was carried out on 207 subjects randomly selected from general population, aged 50-77 years, who underwent liver MRI including in-phase/opposed-phase and multiechoT2*-weighted sequences. Diagnosis of steatosis was made by a combination of ultrasound and MRI. Quantitative T2*maps of entire cross-sectional area of liver was calculated on a pixel-by-pixel basis using a semi-automated software to measure meanT2* of whole liver.
Results: The mean T2*values were significantly lower in fatty liver group compared with normal individuals ($p=0.02$). Male subjects with NASH had statistically lower T2* than NAFLD group in multivariate analysis (OR 0.71, 95% CI 0.53-0.95), while this was not demonstrated in female subjects. Unlike women, there was negative significant correlation between ALT level and T2*values in men with NASH and NAFLD (r=-0.77vs. r=-0.45, respectively). Every 1 IU/ml increment in ALT was associated with 9.07 milliseconds decrease in T2* (95% CI, 3.8-14.3, $p=0.003$) in men with NASH.
Conclusion: Estimated hepatic iron content in MRI is directly correlated with liver enzyme level in men, which may support the role of iron in possible progression to NASH in simple steatosis. In contrast, lack of such correlation in women could be attributed to relatively lower liver iron storage.

B-0365 11:15

Accuracy of liver fat quantification by CT, MRI and US: a prospective comparison with magnetic resonance spectroscopy (MRS)

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Purpose: The hallmark feature of non-alcoholic fatty liver disease (NAFLD) is the accumulation of triglycerides within hepatocytes (steatosis), which causes inflammation, fibrosis, and cirrhosis. MR-spectroscopy (MRS) is regarded as the non-invasive standard for quantification of tissue triglycerides. The purpose of this study was to evaluate the accuracy of quantitative chemical shift-encoded MRI, dual-energy CT (DECT) and ultrasound (US) to quantify steatosis.
Methods and Materials: 25 patients (56±5 years, 10m/15f) scheduled for CT-colonography (CTC) were recruited. All underwent CTC, MRS, MRI and US within 2 hours. 3 MRS voxels were placed throughout the liver; DECT, MRI and US measurements were subsequently co-localised. For CT, Hounsfield Units (HU) as well as fat density (FD) derived from DECT were recorded. For MRI, proton density fat-fraction (PDFF) measured from the chemical shift-encoded method (IDEAL-IQ), and for US, shear-wave velocity, SNR and attenuation were recorded. Data were analysed using linear regression for each technique compared to MRS. 2-sided Student t-tests (0.05 significance level) were used with the hypothesis that the slope coefficient is zero.
Results: There was excellent correlation between MRS-PDFF vs MRI-PDFF (r^2=90.57-98.46, $p < 0.05$) and CT-HU (r^2=89.97-92.38, $p < 0.05$). CT-FD showed moderate correlation with MRS-PDFF (r^2=50.75-59.14, $p < 0.05$). None of the US based metrics showed reliable correlation with MRS-PDFF ($r^2 < 20.32$, $p > 0.05$).
Conclusion: We evaluated different non-invasive modalities to serve as biomarkers for evaluation of NAFLD. Quantitative chemical shift MRI-PDFF and CT-HU showed excellent correlation to MRS-PDFF. Material decomposition with DECT (CT-FD) did not improve the accuracy of fat quantification. US was not accurate for liver-fat quantification.
Author Disclosures:
H. Kramer: Grant Recipient; UW Madison Radiology R&D. **P.J. Pickhardt:** Grant Recipient; NIH. Research/Grant Support; NIH. **M.A. Kliewer:** Research/Grant Support; NIH. **D. Hernando:** Research/Grant Support; NIH. **G. Chen:** Research/Grant Support; NIH. **S.B. Reeder:** Grant Recipient; NIH. Research/Grant Support; Bracco Diagnostics.

B-0366 11:24

Comparison of modified dixon-sequences and H1-spectroscopy for quantitative assessment of liver steatosis in patients with gestational diabetes

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Purpose: Patients with gestational diabetes have a substantial increased risk for the development of type-2 diabetes. Liver steatosis has been identified as an independent risk factor for diabetes. H1-spectroscopy is an established method to measure liver fat content but is restricted to small voxel elements, long acquisition time and complicated post-processing. Fast-modified Dixon sequences (mDixon) have been shown to be an alternative for liver fat assessment. Aim of this study was to compare mDixon with H1-spectroscopy for quantitative assessment of liver fat content.
Methods and Materials: Patients with a history of gestational diabetes within the last 6 months underwent both H1-spectroscopy (STEAM, TE 10 ms, TR 2000 ms, FA 90, voxel size 1.5x1.5x1.5 cm^3) placed in segment VII of the liver and mDixon imaging (TE first 1.5 ms/second 2.7 ms, TR 4.1 ms, FA 10) at a 3 Tesla scanner.
Results: 54 patients (mean age 28.5±4.1 years, mean BMI 27±3.7) were included. H1-spectroscopy (average acquisition time 8 minutes) and mDixon sequences (average acquisition time 30 seconds) were successfully performed. Liver fat content was significantly higher in the mDixon sequences compared to H1-spectroscopy (5.1±6.5% vs. 2.4±5.7%, $p < 0.001$). Correlation between both techniques was excellent (Pearsons' R 0.96). Inter-reader agreement was excellent for both acquisition techniques, with an intraclass-correlation coefficient of 0.97 and 0.96, respectively.
Conclusion: This study demonstrated an excellent correlation between mDixon and H1-spectroscopy for measurements of liver fat content. However, absolute values are higher with the mDixon sequence. Other fat compartments such as abdominal fat can also be assessed by mDixon within the same sequence.

B-0367 11:33

Are MR diffusion-weighted, hepato-specific contrast-enhanced and susceptibility-weighted imaging surrogate markers for advanced liver fibrosis detection in chronic liver disease patients?

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Purpose: To assess whether apparent diffusion coefficients (ADC) using diffusion-weighted imaging (DWI), signal intensity measurements on susceptibility-weighted imagines (SWI), and measurements of gadoxetic acid-enhanced liver parenchyma intensity correlate with histologically proven fibrosis, and to compare their diagnostic value as non-invasive methods for liver fibrosis staging.
Methods and Materials: Seventy-six patients underwent a 3 T MRI examination [including DWI, gadoxetic acid-enhanced T1-weighted MRI, and SWI sequences] and liver biopsy. Fibrosis was staged using the Metavir scoring system: F0 (n=17, 21.2%); F1 (n=10, 12.5%); F2 (n=12, 15%); F3 (n=11, 13%); and F4 (n=26, 37.5%). Signal intensity (SI) of the liver was defined using region-of-interest measurements to calculate the mean ADC values, the relative enhancement (RE) in the hepatobiliary phase (20 minutes after gadoxetic acid administration), and the liver to muscle ratio (LMR) measurements for SWI. The diagnostic performance of the three parameters for distinguishing F0-F2 (no to moderate fibrosis) from F3-F4 (severe fibrosis) was assessed using receiver operating characteristics (ROC) analysis.
Results: Liver fibrosis correlated strongly with SWI LMR ($r=-80$, $p < 0.0001$) and moderately with RE ($r=-61$, $p < 0.000$) and mean ADC (-0.58, $p < 0.0001$). The best diagnostic performance in detecting severe liver fibrosis was obtained for LMR SWI measurements, with an AUROC of 0.90 (Se=98%, Sp=69.4%). RE measurements and DWI performed comparably, with an AUROC of 0.85 (Se=88.2%, Sp=91.3%), and 0.77 (Se=67.3%, Sp=85.7%), respectively.
Conclusion: The diagnostic performance of DWI, gadoxetic acid-enhanced MRI, and SWI to identify patients with severe liver fibrosis was comparable in our cohort, but the AUROC values favour SWI as the best diagnostic modality.

B-0368 11:42

Comparison of mDixon sequences and T1-weighted images in the determination and quantification of adipose tissue compartments with whole-body 3 T-MRI

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Purpose: T1-weighted (T1w) images can quantify fat distribution patterns, which have a predictive value for the development of chronic diseases like type-2 diabetes. Modified Dixon sequence (mDixon) can generate fat only images with high contrast between fat and lean tissue. Aim of this study was to evaluate mDixon for assessment of fat-distribution in whole-body MRI using T1w as reference standard.
Methods and Materials: Ten healthy volunteers (6 female; age: 24±3 years; BMI 22.3±3.8) had a whole-body MRI at 3 Tesla using axial T1w and mDixon sequences. Bodies were divided into five anatomic regions (upper extremity, head/neck, thorax, abdomen, lower extremity) and subcutaneous, visceral and whole body fat was determined using a dedicated software analysis tool. Image quality and image contrast, specifically the ability to differentiate fat from surrounding tissue, were assessed using a visual analogue scale from 1-5 (VAS, 5=best).
Results: 50 anatomical regions were evaluated in each sequence. There was no significant difference in relative total body and relative visceral fat content in mDixon and T1w (total: 30.7±6.4% vs. 30.7±6.3%, p=1.0, visceral: 6.6±2.7% vs. 6.7±3.1%, p=0.82). All measurements showed an excellent correlation (total: Pearson's R=0.99 for total and R=0.88 for visceral body fat). The VAS displayed a significant better image quality and contrast of the mDixon both for subcutaneous (3.6±0.5 vs. 4.3±0.6, p=0.001) and visceral fat (3.0±0.0 vs. 4.7±0.5 > p=0.001).
Conclusion: mDixon provides better tissue contrast for the quantification of adipose tissue compared to conventional T1w and quantitative results do not differ significantly between these two sequences.

10:30 - 12:00 **Room N/O**

Vascular

SS 515

Developments in MR imaging

Moderators:
D. Brisbois; Liege/BE
R.N. Planken; Amsterdam/NL

B-0369 10:30

Non-contrast-enhanced quiescent interval single-shot MR angiography at 3 Tesla in patients with advanced peripheral arterial occlusive disease

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Purpose: The aim of this study was to assess the diagnostic performance of non-contrast-enhanced ECG-gated quiescent interval single-shot (QISS) magnetic resonance angiography at 3 Tesla in patients with advanced peripheral arterial occlusive disease (PAOD).
Methods and Materials: A total of 21 consecutive patients with advanced PAOD (Fontaine stage IIb and higher) referred for peripheral magnetic resonance angiography (MRA) were included. Imaging was performed on a 3 T whole body MR scanner. Image quality and stenosis diameter were evaluated in comparison to contrast-enhanced continuous table and TWIST MRA (CE-MRA) as standard of reference. QISS images were acquired with a thickness of 1.5 mm each (high-resolution QISS, HR-QISS). Two blinded readers rated the image quality and the degree of stenosis for both HR-QISS and CE-MRA in 26 predefined arterial vessel segments on 5-point Likert scales.
Results: With CE-MRA as the reference standard, HR-QISS showed high sensitivity (94.1%), specificity (97.8%), positive (95.1%), and negative predictive value (97.2%) for the detection of significant (≥ 50%) stenosis. Interreader agreement for stenosis assessment of both HR-QISS and CE-MRA was excellent (κ-values of 0.951 and 0.962, respectively). As compared to CR-MRA, image quality of HR-QISS was significantly lower for the distal aorta, the femoral and iliac arteries (each with $p < 0.01$), while no significant difference was found in the popliteal ($p = 0.09$) and lower leg arteries ($p = 0.78$).
Conclusion: Non-enhanced ECG-gated HR-QISS performs very well in subjects with severe PAOD and is a good alternative for patients with a high risk of nephrogenic systemic fibrosis.

B-0370 10:39

Magnetic particle imaging (MPI): direct quantification of vascular stenosis

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Purpose: Purpose of this study was to visualise and quantify different vascular stenoses using Magnetic Particle Imaging (MPI).
Methods and Materials: Nine standardised stenosis-phantoms were used, each featuring a circular lumen of 10 mm diameter. The lumen narrowed conically to different circular stenoses of 1 mm diameter amounting to 99% of the cross section, 2 mm/96%, 3 mm/91%, 4 mm/84%, 5 mm/75%, 6 mm/64%, 7 mm/51%, 8 mm/36% or 9 mm/19%, respectively. For MPI, the phantoms were filled with a dilution of 5% Resovist (Bayer Pharma). Images were acquired using a pre-clinical MPI-demonstrator (Philips Research, Hamburg,

Germany). For comparison, the same stenosis-phantoms were evaluated with contrast-enhanced CT and MRI (Siemens Definition AS64, 12% Imeron 300 (Bracco Imaging); Philips Achieva 1.5 T, 3% Gadovist (Bayer Vital)).
Results: MPI was able to visualise all stenoses accurately but the highest (1 mm/99%; spatial resolution of about 1x3x3 mm^3). CT exhibited the highest spatial resolution, followed by MRI, both modalities were able to visualise all stenoses. MPI was able to detect the residual lumen of the 1 mm/99% stenosis using signal quantification. Furthermore, it was possible to reliably quantify the extent of the stenoses down to 5 mm/75%. Higher grade stenoses were underestimated, the stenosis of 84% was measured as 75%, 91% as 79%, 96% as 81% and 99% as 90%.
Conclusion: Direct quantification of vascular stenoses using MPI is possible. In current experimental MPI-systems, signal interferences can aggravate the MPI-signal of smaller objects, thus distorting their quantification. However, MPI is still able to detect small structures like residual lumina in high grade vascular stenosis using the raw MPI-signal.
Author Disclosures:
J. Rahmer: Employee; Philips Research.

B-0371 10:48

High-resolution TOF MRA at 7T versus DSA for assessment of arteriovenous malformations

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Purpose: The aim of this trial was to compare the diagnostic competence of high-resolution 7 Tesla TOF MRA with digital subtraction angiography (DSA) for assessment of AVM.
Methods and Materials: 15 patients with known AVM prospectively underwent pretreatment DSA and a 7 Tesla MRA (Magnetom 7T, Siemens Healthcare) obtaining a high-resolution Time-of-flight MRA (voxel size of 0.2 x 0.2 x 0.2 mm3). Two readers in consensus evaluated the delineation of the AVM (1) nidus, (2) feeder, (3) drainer, and (4) relationship between AVM and the adjacent brain structures (5) vessel-tissue contrast as well as (6) artifact impairment for both datasets using a 5-point scoring system.
Results: Both imaging modalities provided high-quality vessel delineation. DSA yielded excellent ratings for assessment of AVM related features (e.g. mean nidus 4.7; mean feeder vessel 4.9). 7T TOF MRA approached equally high scoring for evaluation of AVM related items (mean nidus 4.6; mean feeder vessel 4.8). Furthermore, 7T TOF MRA allowed for assessment of the relationship between AVM and adjacent brain structures. Only minor impairments due to signal variations were noted for MR imaging (mean 4.5).
Conclusion: Based on the increased spatial resolution and high-quality vessel-tissue contrast, ultra-high-field TOF MRA enables superior assessment of AVM and its associated vessel structures.

B-0372 10:57

Non-contrast-enhanced T1w MRA of the lower extremity vessels at 7 Tesla

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Purpose: Investigation of the feasibility of non-contrast-enhanced (NE) T1-weighted MRA of the lower extremity arteries at 7 Tesla (T) and comparison to contrast-enhanced (CE) MRA at 1.5 T.
Methods and Materials: 12 healthy volunteers were examined on a 7T whole-body MR-system utilising a custom-built 16-channel transmit/receive coil and a manually positionable AngioSURF table for multi-station imaging. T1w NE-Turbo-FLASH imaging with phonocardiogram gating was acquired covering the vasculature from pelvis to feet. 7 subjects underwent a concomitant ce-MRA at 1.5 T (1M-gadobutrol 0.1 mmol/kg BW). Qualitative image analysis and presence of artifacts were assessed using a five-point scale in the (1) iliacal, (2) femoral, (3) popliteal, (4) tibiofibular and (5) foot segment. Contrast-ratios (CR) of the analysed arterial segments and adjacent soft tissue were obtained for quantitative assessment.
Results: Both MRA techniques provided an overall high-quality conspicuity of the arterial vasculature, with 7T Turbo-FLASH imaging yielding a homogeneously hyperintense delineation of the non-enhanced arteries. While 7T NE-MRA showed slight artifact impairment in all assessed arterial segments (e.g. iliacal 4.21, feet 4.6), 1.5 T ce-MRA only showed focal minor impairment of the foot segment (4.7). Quantitative analysis revealed equivalent contrast ratios for most assessed segments in both MRA techniques, with superior mean values for 1.5 T ce-MRA for the iliacal (NE-7T 0.50, ce-1.5 T 0.86) and femoral (NE-7T 0.66, CE-1.5 T 0.78) arteries.
Conclusion: Our results demonstrate high-quality imaging of the lower extremity arteries with 7 Tesla non-contrast-enhanced T1w MRA, yielding comparable image quality to 1.5 T CE-MRA.
Author Disclosures:
L. Umutlu: Consultant; Bayer AG.

B-0373 11:06

Non-enhanced T1-weighted imaging of the visceral arteries at 7 Tesla

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Purpose: Aim of the study was to assess the feasibility of different non-contrast-enhanced T1-weighted (w) sequences for imaging of the visceral arteries of the upper abdomen at 7 Tesla.
Methods and Materials: 10 healthy volunteers were examined on a 7T whole-body MR-system utilising a custom-built 8-channel transmit/receive coil. The following non-enhanced sequences were acquired: T1w 2D_FLASH, T1w 3D_FLASH and Time of flight (TOF)-MRA in transversal orientation. The delineation of the following visceral arteries was evaluated: right and left common hepatic artery, coeliacal and splenic artery, superior and inferior mesenteric artery. For qualitative analysis, image quality and the presence of artifacts were assessed using a five-point scale. Contrast ratios of the above named arteries in correlation to adjacent liver tissue or psoas muscle were calculated for quantitative assessment.

Results: All three sequences provided a homogenous hyperintense delineation of the assessed visceral arteries. TOF-MRA provided best overall image quality (TOF 4.17, 2D_FLASH 3.42, 3D_FLASH 3.46) and highest mean values for image quality for all analysed vessel segments as well as least impairment due to artifacts (overall artifacts TOF 4.08, 2D_FLASH 3.50, 3D_FLASH 3.46). Quantitative image analysis confirmed the superiority of the TOF sequence showing significant higher CR values for all visceral arteries due to an effective suppression of background signal (e.g. right hepatic artery TOF 4.25, 2D_FLASH 3.54, 3D_FLASH 3.33; $p < 0.05$).
Conclusion: Non-contrast-enhanced T1w imaging in general and, TOF-MRA in particular, appear to be promising techniques for good quality assessment of visceral arteries without the need of contrast media at 7T.
Author Disclosures:
L. Umutlu: Consultant; Bayer AG.

B-0374 11:15

Contrast enhanced MR angiography of renal arteries in living kidney donors - comparison with CT-angiography

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Purpose: CT angiography (CTA) is regarded the gold standard in noninvasive assessment of abdominal arteries, however it has a burden of ionizing radiation. The purpose of our study was to assess the quality of images of renal arteries in living kidney donors acquired with MR angiography (MRA) and compare them with CTA.
Methods and Materials: 40 potential living kidney donors were examined. CTA was performed on a 64-row scanner (Aquilion, Toshiba, Japan). 150 ml of contrast medium was administered in a triphasic automatic injection. MRA was performed on 1.5 T unit (Ingenia, Philips, The Netherlands). Contrast medium in a dose of 0.2 ml/kg body weight was injected at a rate of 2 ml/s. The MRA images were acquired with T1 3D sequence. The number and size of renal arteries were assessed in both studies. The quality of renal artery images in MRA was assessed with a four-point scale (very good, good, bad, vessel not visualised).
Results: CTA showed 108 arteries supplying 80 kidneys. In MRA, 107 arteries were visualised - one 2 mm extra artery was not detected. The quality of images was very good in 93 cases (87%), good in 8 (7.5%), and bad in 6 (5.5%). Features of fibromuscular dysplasia were not detected in one artery in MRA. In 45% of arteries, 1-2 mm underestimation of diameter occurred in MRA. In the remaining cases, the measurements were concordant.
Conclusion: MRA shows a good agreement with CTA, however underestimation of arterial diameter may lead to serious discrepancies in selected cases.

B-0375 11:24

Contrast paramagnetic enhancement of coronary atherosclerotic lesions as extension of CE-MRI of the heart

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Purpose: We evaluated the CE-MR imaging of atherosclerotic plaques in patients with coronary atherosclerosis and recent myocardial infarction.
Methods and Materials: 22 patients with verified coronary atherosclerosis were studied, 10 with predominantly right coronary artery disease and 12 with stenosis of the left circumflex coronary artery. The CE MRI study of the heart was carried out using T1-w scan with end-diastolic ECG gating obtaining 7 mm slices of the whole heart. TR was 450 ms, TE = 15 ms, matrix 256 x 256, with voxel 0.1 _ 0.12 mm. Paramagnetic was injected as 2 ml of 0.5 M solution per 10 kg of BW. For the atherosclerotic plaque itself and arterial wall outside the

plaque, the index of image enhancement was calculated as ratio of intensities on T1-w.SE scan.
Results: When analysed visually the T1-w CE-MR scan provided sure delineation of stenoses of coronary arteries due to uptake of paramagnetics to the plaque. In patients of control group, the RCA IE was 1.08 ± 0.06, and LCA IE 1.09 ± 0.07. The atherosclerotic plaque in infarction-dependent LCA demonstrated IE as high as 1.54 ± 0.22, whereas in infarction-dependent LCA the plaque was enhanced with IE=1.42 ± 0.18. Also the areas of infarction-dependent arteries far from plaques demonstrated mild enhancement with IE in ranges 1.16-1.18. No significant correlation was revealed between IE and degree of stenoses or LV contractility indices.
Conclusion: CE-MRI of coronary atherosclerotic plaques can be suggested as addition to CE myocardial studies for better depiction of atherosclerosis.

B-0376 11:33

3D non-contrast-enhanced, ECG-gated MR angiography of the lower extremities at 3.0 T: comparison with contrast-enhanced MR angiography
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Purpose: To determine objective and subjective image quality and diagnostic confidence of non-contrast-enhanced ECG-gated MR angiography (NE-MRA) of the lower extremities compared to gadolinium-enhanced MR angiography (CE-MRA) at 3.0 Tesla.
Methods and Materials: 27 patients with PAOD underwent multistep, ECG-gated 3D T2-weighted TSE NE-MRA (TRANCE, TR=1000 ms, TE=75 ms, voxel size 1.7x1.7x4 mm). Systolic and diastolic datasets were acquired after individual planning of the diastolic acquisition window. After subtraction, MIP projections were calculated. CE-MRA was performed within the same examination at a 3.0 T MR system (Ingenia, Philips). CNR was determined for the iliacal, femoral and popliteal arteries. Subjective image quality (5-point-scale), sensitivity and specificity for detection of arterial stenoses and occlusions (1: no stenosis, 2: 1-49%, 3: 50-74%, 4: 75-99%, 5: occlusion) was determined.
Results: CNR was 25.7 ± 1.4 for NE-MRA and 28.4 ± 1.6 for CE-MRA (p=ns). Subjective image quality was 4.4 ± 0.1 vs. 4.7 ± 0.1 for NE-MRA and CE-MRA (p=ns). Lesions (grade 3-5) were detected with a sensitivity and specificity of 98.4% and 93.4% compared to CE MRA. The degree of stenosis was overestimated in 24.7% and underestimated in 3.5% by NE-MRA.
Conclusion: NE-MRA of the lower extremities at 3.0 T is a promising method in patients with severe renal dysfunction (risk of nephrogenic systemic fibrosis). Although providing slightly inferior subjective image quality and a lower CNR compared to CE-MRA, NE-MRA (TRANCE) offers an alternative MR angiography method for patients with PAOD and renal failure with acceptable high diagnostic accuracy.

B-0377 11:42

7T vs 1.5 T TOF MRA for assessment of intracranial aneurysms: the more Tesla, the better?
L. Umutlu, K. Wrede, C. Moenninghoff, S. Johst, P. Dammann, M. Forsting, M. Schlamann; *Essen/DE (Lale.Umutlu@uk-essen.de)*

Purpose: Aim of this trial was to compare the diagnostic ability of 1.5 versus 7 Tesla TOF MRA for assessment of intracranial aneurysms.
Methods and Materials: 17 subjects were examined on a 1.5 Tesla (Magnetom Aera, Siemens Healthcare) and Time-of-flight MRA with a voxel size of 0.7x0.7x0.7 mm3 was obtained. Subsequently all subjects underwent a 7 Tesla examination (7T whole-body MR system; Magnetom 7T, Siemens Healthcare) with a voxel size of 0.2 x 0.2 x 0.2 mm3. Two radiologists in consensus assessed the delineation of the (1) aneurym dome, (2) neck, (3) parent vessel, (4) vessel tissue contrast and (5) image impairment due to artifacts. For qualitative analysis a 5-point scale was used (5= excellent delineation; 1= non-diagnostic). Contrast ratios (CR) of all aneurysms and adjacent parenchyma were calculated. A Wilcoxon rank test was performed for analysis of statistical significance.
Results: According to qualitative analysis 7 Tesla TOF MRA yielded significantly superior delineation of dome (mean 7T:=4.5; mean 1.5 T= 3.2; $p < 0.5$) and neck (mean 7T=4.6; mean 1.5 T=3.3; $p < .05$) over 1.5 MRA. Based on increased signal alterations, 7T MRA showed slightly decreased CR of aneuryms to adjacent parenchyma (mean 0.60) over 1.5 MRA (CR mean 0.66; $p < 0.05$), also reflected in increased image impairment of subjective ratings (mean 7T=3.8; mean 1.5 T=4.5).
Conclusion: High-resolution 7T TOF MRA may bear the potential to provide superior assessment of the aneurysms and their related vessel-features based on high-quality vessel-tissue contrast and imaging at improved spatial resolution.

B-0378 11:51

Whole brain 3D-black-blood 3 T-MRI for the diagnosis of CNS vasculitis: a feasibility study
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Purpose: Although 2D-T1w black-blood sequences are able to detect atherosclerotic and inflammatory changes of intracranial vessels they are time extensive and thus limited to a small field-of- view. We sought to evaluate a commercially not available isotropic 3D whole-brain-black-blood T1w-TSE sequence with variable flip angles (3D-BB-VISTA) for the diagnosis of cerebral vasculitis.
Methods and Materials: 10 patients with suspected vasculitis and 15 tumor patients without any evidence of vascular disease received a standardised protocol (T1w pre- and post contrast, TOF, DIFF, T2, FLAIR) and a T1w 3D-BB-VISTA sequence pre- and post contrast (resolution=0.8 mm isotropic, scan-time 4:56 minutes). Left and right arteries of the anterior and posterior circulation (100 arterial segments) were evaluated by two experienced readers in consensus decision for the presence of stenosis and contrast enhancement of the vessel wall.
Results: 3 out of 40 (7.5%) arterial segments in patients with suspected vasculitis showed focal contrast enhancement and luminal narrowing (1x left vertebral artery, 2x left middle cerebral artery). These findings were found in three distinct patients in which vasculitis was clinically confirmed. One patient with sickle-cell disease had a stenosis and concentric wall thickening without contrast enhancement. None of the 60 arterial segments of the tumor patients showed any signs of contrast enhancement or luminal narrowing.
Conclusion: Whole-brain-black-blood MRI is feasible in less than 10 minutes scan time and allows to accurately diagnosing CNS vasculitis. Future studies will be necessary to evaluate the utility of this sequence for other vascular pathologies, such as arterial dissection and atherosclerosis.

10:30 - 12:00 **Conf. Room M3**

Interventional Radiology

SS 509

Transarterial chemoembolisation (TACE)

Moderators:
K. Malagari; Athens/GR
K. Zelenak; Martin/SK

B-0379 10:30

Experimental study on transarterial administration of VEGF siRNA combined with transarterial chemoembolisation in rats with hepatocellular carcinoma
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Purpose: To evaluate the effects of transarterial administration of vascular endothelial growth factor siRNA (VEGF siRNA) combined with transarterial chemoembolisation (TACE) vs. TACE alone for the treatment of hepatocellular carcinoma (HCC) in rats.
Methods and Materials: Subcapsular implantation of a solid Morris-hepatoma 3924 A in the liver was carried out in 20 male ACI rats (day 0). Tumor volume (V1) was measured by MRI (day 12). After laparotomy and retrograde placement of a catheter into the gastroduodenal artery, the following agents of interventional treatment were injected into the hepatic artery (day 13): (A) TACE (0.1 mg mitomycin+0.1 ml lipiodol+5.0 mg degradable starch microspheres)+2.5nmol VEGF siRNA (n=10); (B) TACE alone (control group, n=10). Tumor volume (V2) was assessed by MRI (day 25) and tumor growth ratio (V2/V1) was calculated. Western blot analysis was performed to assess the protein expression level of VEGF in each treatment. Quantization of positive VEGF tumor cells was carried out by immunohistochemical examination in all rats.
Results: The mean tumor growth ratios (V2/V1) were 1.2853±0.1568 in group A (TACE+VEGF siRNA) and 3.0239±0.2098 in group B (TACE alone). Group A showed significant inhibition of tumor growth ($P < 0.01$) compared with the control group B. There were significant differences in VEGF expression levels between group A and group B by Western blot analysis ($P < 0.01$). Lower expression of VEGF in HCC was observed in group A vs. group B by immunohistochemical examination ($P < 0.05$).
Conclusion: Combined TACE and transarterial administration of VEGF siRNA is more effective than TACE alone for growth inhibition of HCC in rats.

B-0380 10:39

Importance of supply of right inferior phrenic artery to segment VIII hepatocellular carcinoma for trans-arterial chemoembolisation

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Purpose: The purpose of the study is to evaluate arterial supply by the right inferior phrenic artery (RIPA) of segment VIII hepatocellular carcinoma (HCC) and its importance in trans-arterial chemoembolisation (TACE).
Methods and Materials: From July 2011 to August 2013, 176 patients underwent TACE for hepatocellular carcinoma. Pre- and post-chemoembolisation liver dynamic studies done on 320-slice CT scanner and digital subtraction angiograms were retrospectively reviewed for tumor location, tumor feeding vessels, technical success of chemoembolisation and tumor response based on Modified Response Evaluation Criteria In Solid Tumors (mRECIST) guidelines.
Results: Segment VIII HCC was identified in 47 (26%) of 176 cases. Chemoembolisation of RIPA was done in 18 (10%) cases, out of which 11 cases had HCC in segment VIII. In 3 out of these 11 cases, disease progression was recognised on follow-up CT; therefore, on subsequent TACE sessions chemoembolisation of RIPA was done after which they showed complete or partial response on further follow-up. In rest of 36 cases of segment VIII HCC, there was an indirect evidence of RIPA supplying segment VIII HCC; in 3 cases, RIPA was not chemoembolised and progression of disease was evident on follow-up, and furthermore 6 cases had CT evidence of RIPA supplying segment VIII HCC when analysed retrospectively.
Conclusion: Routine selective chemoembolisation of right inferior phrenic artery is necessary in all segment VIII hepatocellular carcinomas as significant number (42%) of segment VIII HCC in our study had an evidence of additional blood supply from right inferior phrenic artery.

B-0381 10:48

Utility of cone-beam computed tomography and Emboguide software for planning and monitoring of transarterial catheter embolisation (TACE) of hepatocellular carcinoma (HCC)

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Purpose: To prospectively evaluate the utility of C-arm cone-beam computer tomography (CBCT) and Emboguide software for planning and monitoring of transarterial catheter embolisation (TACE) of HCCs and report on feasibility and short-term clinical outcome.
Methods and Materials: Between November 2012 and September 2013, 35 patients (25 men, 10 women, mean age 76.4 years) underwent TACE of HCC nodules (67 nodules, mean nodule size 27.5 mm). Intra-procedural dual-phase CBCT (arterial and venous) after intra-arterial contrast administration was performed to visualise the HCC nodules and to determine the nodule arterial feeders using dedicated Emboguide software. TACE was performed with doxorubicine mixed with lipiodol and non-enhanced CBCT was performed after TACE. CBCT images acquired before and after TACE were registered to evaluate drugs tumour filling. CBCT lesion detection accuracy, tumour arterial feeders detection accuracy and number of catheter re-positioning on the basis of CBCT and Emboguide software information were recorded. Clinical success was measured as lack of enhancement on follow-up CT.
Results: All procedures were completed successfully without complications. Intra-procedural C-arm CBCT detected of the 67 lesions (100%). The TACE catheters were repositioned on the basis of CBCT and Emboguide software in 25 lesions (37.3%). Clinical success was achieved in 55 of the lesions (82.1%), while 12 (17.9%) presented with local recurrence on follow-up imaging.
Conclusion: Planning and monitoring of HCC nodule TACE using C-arm CBCT and Emboguide software is feasible and leads to establish the correct HCC arterial feeders allowing to perform a selective TACE.

B-0382 10:57

Transcatheter intra-arterial MRA for accurate guidance of TACE in patients with HCC

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Purpose: Evaluation of transcatheter intra-arterial MRA (TI-MRA) with conventional digital subtraction angiography (DSA) for accurate guidance of selective transarterial chemoembolisation (TACE) of hepatocellular carcinoma (HCC).
Methods and Materials: 26 patients with unresectable HCC underwent 57 TI-MRA procedures. Prior to embolisation, a catheter was inserted into HCC supplying sub-/segmental arteries under x-ray fluoroscopy-guidance. Contrast-enhanced TI-MRA (20 ml Gadolinium-DOTA 5% Dotarem, Guerbet, France) was performed using either FLASH3D- or VIBE-sequences (Siemens Magnetom Aera 1.5 T) for acquisition of tumour perfusion. CT after chemoembolisation by injection of lipiodol/doxorubicin from identical catheter position was used to determine the perfused liver area, which was matched to the area seen by TI-MRA.
Results: TI-MRA confirmed initial correct catheter positioning in 94% of patients and led to catheter repositioning in three patients. One erroneous adrenal gland embolisation and two embolisations of wrong liver-segments were avoided. Additional collateral tumour supply was evident in four cases because of incomplete perfusion of HCC in TI-MRA via a single catheter position. Additionally, new HCC-nodules were identified; TI-MRA depicted two patients with two satellite HCC-nodules, which were later visible in follow-up staging MRI. Mean SNR for tumour depicted VIBE in arterial and venous phase superior to FLASH3D ($p < 0.02$, resp. $p < 0.01$)]. CNR was statistically not different.
Conclusion: TI-MRA proved beneficial to detect correct catheter positioning and prevented erroneous/insufficient tumour embolisation. VIBE was favourable to FLASH3D. Compared with an IR-angiosuite with DynaCT functionality, TI-MRA lacks ionizing radiation exposure but requires time-consuming patient transfer between IR/MRI unit.

B-0383 11:06

Caudate lobe hepatocellular carcinoma treated with selective chemoembolisation: usefulness of C-arm CT performed at the proper hepatic artery or equivalent

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Purpose: To evaluate the usefulness of C-arm CT performed at the proper hepatic artery or equivalent in patients with caudate lobe hepatocellular carcinoma (HCC) for detection of the tumour-feeding artery during chemoembolisation
Methods and Materials: From July 2009 to June 2012, 1069 patients with HCC underwent C-arm CT, and caudate lobe HCCs were found in 69 patients. Among 69 patients, 17 patients was excluded because of size less than 1 cm (n=6), hypovascular HCC (n=7), and presence of portal vein thrombosis (n=4). Finally 52 patients were included. Two radiologists reviewed the C-arm CT findings and treatment response on the first enhanced follow-up CT. And then cumulative local recurrence rate was calculated
Results: Among 52 cases, we could find tumour-feeding arteries and their origin in 48 individuals (92.3%). Selective chemoembolisation via tumour-feeding arteries was succeeded in 42 patients (87.5%). The cumulative local recurrence rates at 6 months, 1 year, and 3 years were 19.4%, 32.8%, and 35.8%, respectively. The cumulative local recurrence rates was significantly lower in the patients who have single tumour-feeding artery and treated with selective chemoembolisation. In the multivariate Cox model for cumulative local recurrence rates, selective chemoembolisation of the tumour-feeding arteries was a significant important factor in lower local recurrence rates (hazard ratio, 0.255; 95% CI: 0.089.0.731; P=0.011)
Conclusion: C-arm CT obtained at the proper hepatic artery or equivalent level can demonstrate most of the tumour-feeding arteries supplying HCCs in the caudate lobe

B-0384 11:15

Improved stability of lipiodol-drug emulsion for TACE of HCC results in improved pharmacokinetic profile: proof of concept using idarubicin

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Purpose: We recently demonstrated that idarubicin was the most cytotoxic drug amongst eleven anticancer drugs on three hepatocellular carcinoma (HCC) cell lines. We aimed to select the most stable idarubicin-lipiodol emulsion and test the hypothesis that a better emulsion stability results in a lower systemic exposure of the drug after transarterial chemoembolisation (TACE) for HCC.
Methods and Materials: Nine emulsions with doxorubicin 50-mg or idarubicin 10-mg and lipiodol 10-mL were prepared using the pumping method. Emulsion stability was evaluated by measuring the separation between phases (aqueous, emulsion and oil) at 37 °C. The approval of the institutional review board was obtained to evaluate the pharmacokinetics of the most stable emulsion (amongst the 9 tested) after intra-arterial injection and bland embolisation (250µm calibrated microspheres) in eight unresectable HCC patients. Blood samples were obtained in all patients at 0, 5, 15, 30, 120 min and 24 hours after TACE to determine Cmax and area under the curve (AUC).
Results: The emulsion idarubicin 2 mg/mL + lipiodol (1:2 v:v) was the most stable emulsion (no phase separation at 48 hours). After injection of the emulsion, mean Cmax was 12.5 ng/mL. An estimation of the bioavailability shows that about 40% of administered idarubicin was not found in the blood and thus, remained in the liver. Compared to doxorubicin-lipiodol emulsion, relative Cmax and AUC were 10 times lower using idarubicin.
Conclusion: Idarubicin-lipiodol emulsion is very stable over time and was associated with a much better pharmacokinetic profile than doxorubicin-lipiodol for TACE of HCC.

B-0385 11:24

Quantitative evaluation of CT perfusion map as indicator of tumor response to transarterial chemoembolisation and radiofrequency ablation

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Purpose: To assess if different interventional treatments (RFA and TACE) may influence the evaluation of perfusion parameters obtained with CT-p.
Methods and Materials: Thirty-three consecutive cirrhotic patients candidates to TACE orRFA were included. CT-p study was performed on 16 multidetectorCT (Brilliance 16,Philips,NL),dose exposure was 120 Kv, 120 mAs.In all cases bolus injection of 50 ml of non ionic contrast agent (350 mgI/ml) at a flow rate of 6 ml/sec was performed and forty dynamic scans were acquired at a fixed table position.A dedicated perfusion software which generated a quantitative map of arterial and portal perfusion by means of colour scale was employed.The following perfusion parameters were assessed before and after TACE:Hepatic perfusion (HP),Arterial perfusion (AP),Blood Volume (BV),Hepatic perfusion Index (HPI),Time To Peak (TTP).
Results: A complete treatment was obtained in 16 cases and incomplete treatment in the remaining cases.The following perfusion data were obtained in partially treated lesions:HP 43.2±15.1 ml/sec/100 gr;AP 38.7±8.8 ml/min; BV 20.7±9.5 ml/100 mg;TTP 24±3.7 sec; HPI 61.7 ±7.5%.Corresponding value calculated in patients without residual tumor were: HP 10.2±6.3; AP 10.4±7;BV 4.05±4.8; TTP 38.9±4.2;HPI 9.9±9.2.While in normal liver the found parameters were:HP 13.2±4;AP 12.3±3.4;BV 11.8±2.8; TTP 43.9±2.9 and HPI 17.1±9.8.A significant difference ($p < 0.001$) was found for all parameters between residual viable tumor tissue ($p < 0.001$)compared to successfully treated lesion,due to the presence of residual arterial vascular structures in viable portion of treated HCC.
Conclusion: According to our results, CT-p evaluation is not influenced by TACE or RFA treatments, thus representing a feasible technique that allows a reproducible quantitative evaluation of treatment response in HCC patients

B-0386 11:33

HCC treated by TACE with iodised oil: is one-month follow-up with MDCT predictive of treatment efficacy? A correlation with longer follow-up

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Purpose: To compare the results of one-month follow-up MDCT after TACE with iodised oil in patients with HCC with those of further follow-up, to confirm the clinical value of routine one-month follow-up.
Methods and Materials: We reviewed the 64-row MDCT scans performed 4 weeks after TACE with iodised oil (Lipiodol, Guerbet) on 29 patients with HCC (26M, 3 F; mean age 67 years): unenhanced, arterial phase, portal-venous phase and equilibrium phase images were available. Up to 2 nodules were analysed per patient, and complete treatment of each nodule was diagnosed based on the absence of residual enhancement. The results were compared with those of subsequent contrast-enhanced imaging (MDCT, MRI or CEUS), with a lesion-by-lesion analysis. Sensitivity, specificity, PPV and NPV for the one-month follow-up were calculated by means of Fisher's test, using the later follow-up as a gold-standard.
Results: A total of 40 nodules were analysed (mean diameter 27 mm). Further follow-up was at an average of 6 months (2-26 months). When the nodule was diagnosed as completely treated at one-month follow-up MDCT, this had 100% sensitivity, 80 % specificity, 94% PPV and 100% NPV compared with subsequent follow-up contrast-enhanced imaging.
Conclusion: Contrast-enhanced multiphasic CT is commonly used for the follow-up of HCC after TACE. The results at one-month follow-up are confirmed by later follow-up imaging.

B-0387 11:42

Combination of Sorafenib and transarterial chemoembolisation (TACE) vs TACE vs Sorafenib protocol alone in advanced stage hepatocellular carcinoma (HCC): retrospective study at three German liver centers

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Purpose: To compare combined Sorafenib and transarterial chemoembolisation (TACE), TACE alone and Sorafenib alone for treatment of patients with advanced hepatocellular carcinoma (HCC) according to Barcelona Clinic Liver Cancer (BCLC) stage C.
Methods and Materials: In this retrospective multicenter cohort study 185 patients with BCLC stage C treated with Sorafenib and TACE (group A, n=50), TACE alone (group B, n=59) or Sorafenib alone (group C, n=76) were retrospectively analysed for comparison from January 2007 to October 2012. Portal vein infiltration, extrahepatic metastases, time-to-progression and overall survival were evaluated. For patients of group A adverse events were also documented.
Results: Portal vein infiltration was documented in 32% of patients in group A, 36% in group B, and 37% in group C. Extrahepatic metastases were present in 60% (group A), 34% (group B), and 49% (group C). Median time-to-progression was 6.3 months in group A, 5.4 months in group B and 3.5 months in group C. Median overall survival was 17.0 months in group A, 11.0 months in group B and 9.0 months in group C. The most common adverse events in the combined Sorafenib and TACE treatment were diarrhea (54%), hand-foot-skin reactions (40%) and fatigue (36%). Due to adverse events, the Sorafinab dose was reduced in 86% of patients in group A and stopped in 6%.
Conclusion: Combined Sorafenib and TACE treatment seems to be a promising treatment option in patients with HCC in BCLC stage C, especially when extrahepatic metastases are present. However, further prospective or randomised studies are necessary.

B-0388 11:51

Comparison between transcatheter arterial chemoembolisation (TACE) and transcatheter arterial chemoembolisation combined with percutaneous radiofrequency ablation (TACE-RFA) for treatment of intermediate hepatocellular carcinoma

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Purpose: To compare safety, tolerability, influence on liver function and efficacy of TACE and single-step balloon-occluded RFA combined with TACE (boRFA+TACE) in patients with unresectable multinodular HCC.
Methods and Materials: 30 patients with HCC treated with boRFA+TACE (Group A) were individually matched according to tumour type, age, sex and liver disease stage with a group of 15 patients treated only with TACE (Group B). The two groups were compared in terms of liver function, major complications, time of hospitalisation, treatment efficacy (1, 6 and 12 months CT, mRECIST criteria) and overall survival (OS).
Results: Hepatic liver function and Child-Pugh score did not significantly differ amongst the two groups at 1 month. Technical success, defined as complete or partial devascularisation during the arterial phase of all nodules obtained on 1-month CT, was achieved in 25/30 patients (83.3%) in A and 12/15 patients (80%) in B, respectively. At 6-month CT, local recurrence was developed in 10/30 (33.3% A) and 5/15 (33.3% B). During one year follow-up, a mean number of procedures per patient of 1.28 and 1.86 were obtained, respectively ($P < .05$). No significant differences were found in terms of OS amongst the two groups (median survival: 392±62 days, A; 487±38 days, B).
Conclusion: Both procedures were safe, well tolerable, not deteriorating liver function, with good results in terms of efficacy and overall survival, without significant differences. However, the use of combined therapy could be more favourable than TACE alone in terms of cost-effectiveness in patients with multinodular unresectable HCC, allowing to reduce the repeated number of treatments.

10:30 - 12:00 **Board Room A**

Head and Neck

SS 508

Head and neck oncology

Moderators:
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B-0389 10:30

PET/MR and PET/CT in follow-up of head and neck cancer patients

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Purpose: Positron Emission Tomography (PET)/Magnetic Ressonance Imaging (MRI) is the emerging hybrid imaging modality. The aim of this study was to assess contrast enhanced (ce) PET/MRI compared to cePET/Computed Tomography (CT) in patients with suspected recurrence of HNC.
Methods and Materials: Eight-seven patients were enrolled in this prospective study. All patients underwent PET/CT-MRI in a tri-modality setup. Diagnostic accuracy concerning detection of recurrent HNC was evaluated for cePET/CT and cePET/MRI, as well as image quality, presence of unclear FDG uptake and diagnostic advantages of use of gadolinium.
Results: CePET/MRI showed no statistically significant difference in diagnostic accuracy compared to cePET/CT (91.5% vs 90.6%). Artefacts grade was similar in both methods, while their location was different. CePET/CT artefacts were primarily located in the supra-hyoid area, while cePET/MRI, artefacts

were more equally distributed among the supra and infra-hyoid neck regions. Both methods showed 34 unclear FDG uptake, of those eleven could be solved by cePET/MRI and five by cePET-CT. The use of gadolinium in PET/MRI didn't yield higher diagnostic accuracy, but helped to define tumour margins in 6.9% of patients.
Conclusion: CePET/MRI might be slightly superior compared to cePET/CT to solve unclear FDG uptake related to possible tumour recurrence in patients with follow-up after HNC. It might also be the imaging tool of choice for evaluation of the oropharynx and the oral cavity based on a higher incidence of technical artefacts in cePET/CT in this area. However, overall there is no statistically significant difference concerning diagnostic accuracy of the two methods.
Author Disclosures:
P. Veit-Haibach: Grant Recipient; Bayer Healthcare and Siemens Medical Solution. Speaker; GE Healthcare. **G. von Schulthess:** Speaker; GE Healthcare.

B-0390 10:39

Use of DWI in PET/MRI for head and neck cancer evaluation
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Purpose: The novel method 18 F-fluorodeoxy-D-glucose (FDG) positron emission tomography / magnetic resonance imaging (PET/MRI) is an attractive alternative to PET/Computed Tomography (CT) on imaging evaluation of head and neck cancers (HNCs). Defining MR protocol is a challenge, since there are many different sequences and acquisition time should not be too long. The aim of this study is analyse whether DWI adds significant information to PET/MRI on lesion detection for HNCs.
Methods and Materials: Seventy patients were enrolled in this prospective study. All patients underwent sequential contrast enhanced (ce)PET/CT and cePET/MRI using a tri-modality PET/CT-MR setup. First, all the lesions were assessed by PET/MRI with conventional sequences and, in a second step, the PET/MRI with DWI sequence. The PET values (Standardised Uptake Value-SUV) and DWI values (Apparent Coefficient Diffusion-DC and B value) of all FDG positive lesions were also evaluated.
Results: One hundred and eighty-eight lesions were found, in which 118 were malignant and 70 were benign. DWI detected 120 lesions, while PET/MRI identified 48 more lesions. DWI showed 20 lesions not seen on PET/MRI. However, those additional lesions did not change the overall staging. SUV maximum and mean were higher in malignant lesions than in benign lesions, but DWI values were not statistically different.
Conclusion: PET/MRI is superior to DWI alone and thus, DWI is not needed in PET-MRI protocols for HNC detection.
Author Disclosures:
P. Veit-Haibach: Research/Grant Support; Bayer Healthcare and Siemens Medical Solution. Speaker; GE Healthcare. **G. von Schulthess:** Speaker; GE Healthcare.

B-0391 10:48

Diffusion-weighted MRI in advanced oropharyngeal carcinoma treated by exclusive chemoradiation therapy: prognostic value of histogram-derived parameters
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Purpose: To assess the prognostic value of histogram parameters extracted from diffusion-weighted (DW) pre-treatment MRI in patients treated by exclusive chemoradiation therapy (CHRT) for advanced oropharyngeal carcinoma.
Methods and Materials: Pre-treatment DW-MRI datasets from patients who underwent CHRT for advanced oropharyngeal carcinoma from October2007 to November2011 were retrospectively reviewed and analysed. Histogram analysis was performed on Apparent Diffusion Coefficient (ADC) maps for primary tumour (T), peritumour ring and largest nodal metastasis (N), resulting in the following parameters: ADC mean, max and min, histogram skewness and kurtosis. Kaplan-Meier analysis was performed to test prognostic value (overall survival, OS; progression-free survival, PFS).
Results: DWI datasets from 27 patients were reviewed by an expert radiologist blinded to clinical outcome. Analysis at T, peritumour and N site was feasible in 23, 23 and 16 patients. Maximum ADC and skewness of T were significantly higher in good responders (n=14) than in poor responders (n=9) (p 0.004 and 0.005, respectively). Multiplying ADC max and skewness, a novel parameter (skew*max) was obtained. At Kaplan -Meier analysis, ADC max, skewness and skew*max, categorised by median split, did correlate with OS, with hazard ratios of respectively 3.47 (p0.02), 6.57 (p0.005) and 15.45 (p0.0004). Similar results were obtained for PFS, being disease progression and mortality strictly associated. Nine out of 11 patients with low skew*max values did relapse during follow-up; only one recurrence was observed in 12 high skew*max patients (p0.002).
Conclusion: Skew*max derived from ADC histograms is a promising prognostic indicator for advanced oropharyngeal carcinoma treated by exclusive CHRT.

B-0392 10:57

Characterisation of head and neck tumors using dynamic contrast enhanced MRI
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Purpose: To assess the diagnostic value of dynamic contract enhanced MRI (DCE-MRI) in differentiation between malignant and benign head and neck (HN) lesions, and between changes caused by radiation therapy.
Methods and Materials: 150 patients with HN tumor were examined using DCE-MRI sequences (Fast Spoiled Gradient Echo FSPGR, 80 phases), beside routine head neck (HN) imaging protocol. The examinations were performed on a 3 Tesla wide bore clinical MR scanner (General Electric Discovery 750w, Milwaukee, USA). As contrast agent gadobenate dimeglumine (Multihance©, Bracco, Italy) were applied. The time intensity curves (TIC) were extracted from the region of interests (ROI) specified by experienced HN radiologists. The TICs were used to acquire time-to-peak (TTP), relative maximum enchancement (RME), relative wash-out (RWO) and other parameters. The parameters were analysed using univariate tests and multivariate models in SPSS 17 to identify predictors that can be used to infer tumor malignancy and post-irradiation status.
Results: Multiple parameters of curve characteristics are significantly different in case of malignant vs. post-irradiation status, and also in case of malignant vs. benign tumors. We investigated the performance of logistic regression to identify the status of a tumor, and found multiple significant ($p < 0.05$) predictors for both benign/malignant status as well as pre- and post-irradiation status.
Conclusion: This large cohort of data supports the increasing role of DCE-MRI in HNT differentiation.

B-0393 11:06

Dynamic contrast enhanced MRI for differentiation of major salivary glands neoplasms, a 3-T MRI study
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Purpose: Evaluate the role of dynamic contrast-enhanced MRI (DCE) for differentiation between malignant, Warthin and benign non-warthin (BNW) neoplasms of major salivary glands.
Methods and Materials: 46 salivary gland neoplasms underwent preoperative DCE. Postoperative histopathologic evaluation was performed for a definite diagnosis. (30 BNW, 6 Warthin, 10 malignant) TIC (Time-signal intensity curves) were categorised as (A) Tpeak> 43s and WR180< 4.6%. (B)Tpeak> 43s and WR180:4.6-22% (C) Tpeak< 43s and WR> 22%.
Results: Accuracy of Tpeak was 98.9% for differentiation between BNW and Warthin, 83.7% between BNW and malignant and 80% between malignant and Warthin. All warthins showed Tpeak≤43s, while one BNW had Tpeak< 43s. A Tpeak< 63.5s differentiated 8/10 (80%) of malignant tumors from BNW, while 4/30 of BNW had a Tpeak< 63.5s. Two malignant tumors had Tpeak< 43s. WR180 had an accuracy of 100% for differentiation between warthin and BNW, 87.3% between BNW and malignant and 93.3% between warthin and malignant tumors. 29 out of 30 (96.7%) BNW had a washout< 4.60%, while 8/10 (80%) of malignant tumors had a washout> 4.60%. All warthins had a WR180> 22%, while two malignant tumors had a WR180> 22%. According to TIC curves, 29/30 of BNW demonstrated TIC curve type A and one demonstrated type B. 6/10 of malignant tumors had TIC type B, 2 had TIC type A and 2 type C. All warthin were categorised in Type C.
Conclusion: This study showed DCE could assist in preoperative differentiation of salivary gland neoplasms; especially regarding discrimination between warthin and BNW tumors.

B-0394 11:15

Assesment of global and locoregional heterogeneity of primary squamous cell carcinoma of the head and neck: association with treatment response and clinical outcome

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Purpose: Our aim was to assess the relationship between CT and MRI evaluation of whole tumour heterogeneity with response to treatment and clinical outcome. We hypothesised that image heterogeneity may reflect underlying tumour biology.
Methods and Materials: Following IRB approval, the imaging heterogeneity of contrast enhanced MDCT (ceCT), contrast enhanced T1-weighted 1.5 T-MRI (ceMRI), and T2-weighted 1.5 T-MRI (T2MRI) of 33 patients (21 men, mean 62.7 years) with primary squamous cell carcinoma of the head and neck were evaluated using global and locoregional methods: first-order statistics; second-order co-occurrence matrices; higher-order run length (GLRL) and neighbourhood grey-tone difference (NGTDM); and model-based fractal analysis (FA). Parameters were compared with Stage, treatment outcome and survival using Mann Whitney and Kaplan Meier statistics.
Results: There was a difference in ceCT and T2MRI parameters between early and advanced cancers ($p < 0.01$). Higher-order locoregional GLRL and NGTDM may better reflect clinical outcome in primary head and neck cancer with a difference between treatment responders/non-responders as well as patients with recurrence/no recurrence ($p < 0.05$). There was a borderline association between ceCT kurtosis and overall survival (log rank p=0.046) in comparison to tumor size where there was no difference, using an optimal 'cut-off' threshold.
Conclusion: While findings are preliminary, assessment of global and locoregional imaging heterogeneity may augment current imaging practice with respect to clinical outcome.

B-0395 11:24

The role of magnetic resonance spectroscopy for differentiation between major salivary glands neoplasms

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Purpose: To assess the role of magnetic resonance spectroscopy (MRS) for preoperative differentiation between benign non-Warthin (BNW),Warthin and malignant neoplasms of major salivary glands.
Methods and Materials: 43 major salivary gland neoplasms (25 BNW, 7 Warthin and 11 malignant) underwent preoperative MRS. Final diagnosis was confirmed with postoperative histopathologic evaluation. MRS was performed with echo times (TE) of 135 and 270 at 3 Tesla. Spectra was analysed to determine peak amplitude of choline (Cho), creatine (Cr) and cho/cr ratio. ROC curve was used to determine optimal cutoff points.
Results: Mean cho/cr at TE135 was 1.84±2.05, 1.16±0.64 and 3.90±3.23 in BNW, Warthin and malignant neoplasms, respectively. Mean cho/cr at TE270 was 1.66±1.85, 0.97±0.47 and 3.18±1.53 in BNW, Warthin and malignant neoplasms, respectively. Cho/cr had an accuracy of 78.9% at TE135 (best cutoff point 1.92 with 81.8% sensitivity and 88% specificity) and 81.5% at TE270 (best cutoff point 1.92 with sensitivity of 81.8% and specificity of 84%) for differentiation between BNW and malignant tumours. MRS was powerful for differentiation between Warthin and malignant neoplasms showing a cho/cr accuracy of 87% and 92.2% at TE135 and TE270, respectively. Cutoff points of 1.59 at TE135 (sensitivity 81.8%, specificity 85.7%) and 1.25 at TE270 (sensitivity 90.9%, specificity 85.7%) were powerful in differentiation between malignant and Warthin neoplasms. MRS was not powerful for differentiation between BNW and Warthin tumours.
Conclusion: This study showed that MRS is helpful in preoperative discrimination of major salivary gland neoplasms.

B-0396 11:33

To evaluate the efficacy of MRI in detection of cartilage invasion and submucosal space involvement in laryngeal cancer for accurate pretherapeutic staging

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Purpose: To evaluate the efficacy of MRI in detection of cartilage invasion for accurate pretherapeutic staging.
Methods and Materials: 33 patients with endoscopically diagnosed laryngeal masses were included in a prospective study. CECT and CEMR were performed to assess cartilage invasion. The median age group was 51-60 years with 29 males and 4 females. 19 patients underwent total laryngectomy with histopathology of the resected specimen. CT was performed on Philips Brilliance 40-slice spiral scanner. CEMRI was performed on Siemens 1.5 T scanner using surface neck coils (slice thickness of 3-4 mm and 1 mm intersection gap).
Results: CT: 14 masses were characterised as T4, 10 as T3, 5 as T2 and 4 as T1. Diagnostic accuracy of CECT was 73% for staging and for cartilage invasion was 78% for thyroid and cricoid and 79% for arytenoid. MR: 15 masses were characterised as T4, 5 as T3, 6 as T2 and 3 as T1 with diagnostic accuracy of 89% for staging. MR had higher accuracy in detecting cartilage invasion with 89% accuracy for thyroid, 78% for cricoid and 84% for arytenoid cartilage. Histopathology: There were 2 false positive MR results for thyroid and arytenoid each and 4 for cricoid cartilage invasion. CECT had lower diagnostic accuracy for staging and for cartilage invasion with 3 false negative results for thyroid cartilage and 2 for arytenoid and cricoid cartilage.
Conclusion: CEMR has higher sensitivity and accuracy in detecting cartilage invasion. MR should be used as first line imaging modality for laryngeal tumour evaluation.

B-0397 11:42

The value of ultrasonographic criteria for the differential diagnosis between benign and malignant cervical lymph nodes

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Purpose: The aim of the study is to explore the diagnostic value of grey scale, Doppler and sonoelastographic criterias for the differentiation between benign and malignant lymph nodes of the neck.
Methods and Materials: Over a period of 42 months (October 2009 - April 2013) the patients examined routinely for the assessment of superficial cervical lymph nodes in the department of ultrasound were recorded in a database containing grey-scale, Doppler and sonoelastographic information and images. The images of 30 benign and 60 malignant (20 lymphomas and 40 metastatic) lymph nodes obtained were chosen. The images obtained at real-time elastography were scored according to a new scoring system using 6 patterns, comparing the sonoelastographic appearence with bidimensional images.
Results: In the multivariate analysis, none of the bidimensional criaterias proved to be independent predictors of malignancy. From the Doppler parameters, the vascular pattern was an indepedent predictor of malignant lymph nodes. It was analysed the diagnostic value of the vascular pattern with area under the ROC curves (AUROC) = 0.89,$p < 0.0001$, sensibility = 90%, specificity= 83.3% and sonoelastographic scores area under the ROC curves (AUROC) = 0.86,$p < 0.0001$, sensibility = 78.3%, specificity= 90%.
Conclusion: In this study, the vascular pattern assessed on Doppler images and the sonoelastographic scores are the most important predictors of malignancy, with a very good sensibility and specificity.

B-0398 11:51

Ultrasound-guided transcutaneous tru-cut biopsy of laryngo hypopharyngeal lesions

G. Conte, E. De Fiori, E. Perucchini, L. Preda, L. De Benedetto, M. Ansarin, M. Bellomi; *Milan/IT (giorgio.conte@ieo.it)*

Purpose: To evaluate the performance of ultrasound-guided transcutaneous tru-cut biopsy (USGTCB) in patients with untreated or previously treated suspicious laryngo-hypopharyngeal masses, who have relative or absolute contraindications for microlaryngoscopy.
Methods and Materials: From August 2004 to April 2013, we prospectively enrolled 62 patients (47 males, 15 females; age 44-95 years), for total of 64 USGTCBs scheduled: 37 USGTCBs were performed for an untreated mass suspicious of malignancy and 27 for suspicious recurrence of malignancy. Biopsies were performed with the free-hand technique by a single radiologist after the preliminary assessment by US of the mass.
Results: USGTCB diagnosed 47 squamous cell carcinomas, 6 other malignant lesions and 11 benign lesions (true positive); no false positives and five false negatives were reported: two in patients with untreated lesions, two in patients previously treated with radiotherapy and one in a patient previously treated with endoscopic laser surgery. Overall, the sensitivity of the technique was 91.4%; the specificity was 100%; positive and negative predictive values were 100% and 54.5%, respectively. Sensitivity, specificity, positive and negative predictive value and accuracy for the procedures performed in previously radio-treated patients were 84.6%, 100%, 100%, 71.4%, respectively.
Conclusion: Although biopsy under microlaryngoscopy remains the "gold-standard" technique for histological diagnosis of both primary and recurrent laryngo-hypopharyngeal masses, USGTCB is a cost-effective procedure that could be applied in patients contraindicated for general anaesthesia or those with a risk of tracheotomy due to intubation difficulties. The performance of USGTCB is adequate even in previously radio-treated patients to differenatiate recurrence of malignancy from radio-necrosis.

14:00 - 15:30 **Room A**

GI Tract

SS 601a

New insights into colorectal cancer

Moderators:
C. Hoeffel; Reims/FR
P. Wylie; London/UK

B-0399 14:00

Diagnostic accuracy of MR vs rigid rectoscopy in assessing the extraperitoneal location of rectal cancers

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Purpose: Our purpose was to compare the diagnostic accuracy of rigid rectoscopy and MR in assessing the extra or intraperitoneal location of rectal cancers, using surgical exploration as reference standard.
Methods and Materials: Patients with surgically proven primary rectal adenocarcinoma were retrospectively identified and all patients who underwent preoperative rectoscopy and MR were enrolled. Patients with a complete response to chemoradiation therapy were excluded. All MR examinations were reviewed by two abdominal radiologists in consensus, determining the intra or extraperitoneal location of tumour's inferior edge. Three different cut-off measurements were used to define the diagnostic accuracy of rectoscopy: < 8 cm, < 10 cm and < 12 cm.
Results: 54 patients (32 male, 22 female, mean age 69.2 years) with surgically proven primary rectal adenocarcinoma (47 extra and 7 intraperitoneal tumours) were included. MR showed a sensitivity and specificity of 95.74% and 100%, respectively. Rigid rectoscopy showed a sensitivity and specificity of 93.75% and 66.67% at 8 cm, 97.87% and 57.14% at 10 cm and 100% and 14.29% at 12 cm (p = 0.007).
Conclusion: MR, due to the direct visualisation of the anterior peritoneal reflection, showed higher specificity than rectoscopy in defining the extraperitoneal location of rectal cancers.

B-0400 14:09

Tumour volumetry on diffusion-weighted MRI for identification of complete tumour responders to preoperative chemoradiotherapy in rectal cancer: a multicenter validation study

D.M. Lambregts[1], S. Sassen[2], S.-X. Rao[1], M.H. Martens[1], L.A. Heijnen[1], G.L. Beets[1], R.A. Vliegen[2], R.G.H. Beets-Tan[1]; [1]*Maastricht/NL*, [2]*Heerlen/NL (d.lambregts@mumc.nl)*

Purpose: Retrospective studies have shown that tumour volumetry using diffusion-weighted imaging (DWI) may help identify rectal cancer patients with a complete tumour response after neoadjuvant chemoradiotherapy (CRT). This study aims to prospectively validate the diagnostic value of previous retrospectively determined volume-thresholds in a larger and multicentric patient cohort.
Methods and Materials: 119 patients from two different centres underwent MRI (1.5 T) including standard T2W-MRI and DWI (highest b-value b1000-1100), both pre- and post-CRT. An experienced reader placed free hand ROIs around the tumour area on each tumour-containing slice to determine pre-CRT and post-CRT volumes (cm3) on T2W-MRI and DWI and calculate ∆volume (=[pre-volume - post-volume]/[pre-volume]*100%). T2W and DWI thresholds (retrospectively determined in previous studies) for pre-volume, post-volume and ∆volume were tested to prospectively assess their diagnostic values in identifying patients with a complete tumour response.
Results: Twenty-one patients had a complete response. Areas under the ROC-curve for the pre-/post-/∆-volumes were 0.73/0.80/0.69 for T2W-MRI and 0.75/0.86/0.78 for DWI. For T2W-volumetry, sensitivity and specificity using the predefined thresholds were 62% and 74% for pre-volume, 52% and 92% for post-volume and 38% and 86% for ∆volume. For DWI-volumetry, sensitivity and specificity were 62% and 77% for pre-volume, 62% and 91% for post-volume and 71% and 80% for ∆volume.
Conclusion: Previously determined DWI volume-thresholds can be reproduced with good results in a prospective and multicenter setting. Post-CRT DWI-volumetry provides the best results for discriminating complete responders with an AUC of 0.86 and - prospectively tested - sensitivity of 62% and specificity of 91%

B-0401 14:18

Diffusion-weighted images in differentiation of granulation tissue from minimal portion of residual tumour in the cases of the assumption of complete response after chemoradiotherapy of patients with rectal cancer

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Purpose: The aim of the study was to determine the differentiation of epithelial granulation from residual tumour in cases of the assumption of complete response after chemoradiotherapy.
Methods and Materials: The study included 86 patients with rectal cancer. Studies were performed on 1.5 T MR imaging with a flexible 4-channel body coil. Analysis was used in the ADC by one section outlined with hand-rendered all parts of the tumor. Maps ADC automatically generated upon completion of DWI sequences. Evaluation ADC of rectal tumors was carried out on the stage prior to the n-CRT and 4-6 weeks after. In all cases, MRI and histology data are compared. Scanning protocol includes multiplanar T2 and T1WI with intrarectal contrasting agent and in DWI with b-factor (0 and 800 mm²/sec).
Results: There were 12 complete responders according to pathomorphological data with no tumour growth among fibrotic mass. According to MRI data (T2WI + DWI), there were considered only 8 complete responders, but 1 (1.2%) case was false-negative because of microfocus (small groups of adenocarcinoma cells) of the tumor which has no chance of MRI detection, there were 7 (8.1%) true-negative cases of complete response. In 5 (5.8%) cases, granulation tissue was wrongly defined as tumor false-positive results. Sensitivity, specificity, accuracy, PPV, NPV were 98.7%, 58.3%, 93%, 93.6% and 87.5%, respectively.
Conclusion: After the retrospective analysis, we found no statistically significant differences between the ADC of the small residual tumour and the granulation epithelial tissue (1.329×10^{-3} mm $^2/_s$ and 1.387×10^{-3} mm $^2/_s$, respectively). This caused a lack of specificity with the method in this difficult group of patients. Therefore, this issue needs further study.

B-0402 14:27

Preoperative 3 T MR imaging of rectal cancer: local staging accuracy using 2D T2-weighted FSE sequence and diffusion-weighted MRI with b-multiple SE-EPI

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Purpose: To evaluate the image quality and diagnostic performance of 2D T2*w* FSE sequence and Dw-MRI with *b*-multiple SE-EPI in the local staging of rectal cancer at 3 T.
Methods and Materials: Forty patients with biopsy-proven rectal cancer underwent MRI at 3 T-device (GE-DISCOVERY MR750; GE Healthcare) using 8-channel phased-array body coil. MR imaging protocol included high-resolution 2D T2w FSE images in sagittal, coronal, axial and axial-oblique planes. Dw-MRI was performed using axial spin-echo echo-planar sequence with multiple *b*-values (150,500.1000,1500 sec/mm²) in all diffusion directions. Two experienced radiologists separately reviewed the 2D T2w imaging data-set alone and the combined set of T2w and Dw-MR images. The reviewers assessed the radiologic T staging with regard to tumor extension to the muscularis propria and perirectal fat invasion and performed image quality assessment of data-sets using a five-point scale.
Results: Thirty-two patients who underwent a total mesorectal excision (TME) were enrolled in the imaging analysis; the remaining 8 patients were excluded because they were classified as stage T1 (two cases) and stage T4 (six cases). The overall sensitivity, specificity and accuracy for prediction of perirectal fat invasion in rectal cancer using the combined set of T2w and Dw-MR images and the T2w imaging data-set alone were 94%, 78%, 87.5% and 77%, 57%, 68.7%, respectively. Image quality analysis was performed in all 40 patients and was excellent on T2w images and good on Dw-MRI.
Conclusion: Diffusion-weighted MR imaging in addiction to T2-weighted MR imaging can improve the local staging of rectal cancer at 3 T.

B-0403 14:36

Diagnostic performance of kinetic parameters derived from dynamic contrast-enhanced MRI for the selection of good responders after chemoradiation for rectal cancer

M.H. Martens, S. Subhani, L.A. Heijnen, D.M. Lambregts, M. Maas, R.G. Riedl, G.L. Beets, E. Kluza, R.G.H. Beets-Tan; *Maastricht/NL (milou.martens@mumc.nl)*

Purpose: Response assessment after chemoradiotherapy (CRT) in rectal cancer remains difficult. The aim of this study was to investigate if kinetic paramters derived from dynamic contrast-enhanced (DCE) MRI, using the blood-pool contrast agent gadofosveset, can identify good responders after CRT.
Methods and Materials: Twenty-five patients with locally advanced rectal cancer received DCE-MRI both before and 8 weeks after CRT. The kinetic parameters i.e., the initial slope, initial peak, late slope, and area under the first 60, 90, and 120s of the enhancement curve (AUC_{60}, AUC_{90}, AUC_{120}) were determined from relative signal enhancement-time curves. Receiver operating characteristics (ROC) curves were used to assess the diagnostic performance. Good responders (n=11) were defined as patients with a tumour regression grade (TRG) of 1 or 2 at histopathologic assessment after resection. Poor responders were defined as patients with a TRG of 3 to 5 (n=14).
Results: Before neo-adjuvant CRT, the late slope was significantly lower for the good responders (-1.61×10^{-3}) compared with the poor responders (5.18×10^{-3}, p=0.004). Post-CRT the initial peak, AUC_{90}, and AUC_{120} were significantly lower in the good responders compared with the poor responders (1.20vs1.53, 102vs128, 145vs181 and p=0.017, 0.028, 0.023 respectively). All parameters except the late slope changed significantly more post-CRT in the good responders compared with the poor responders. ROC-curves ranged from 0.73 to 0.83.
Conclusion: Kinetic parameters derived from dynamic contrast-enhanced MRI are a promising tool for prediction and assessment of response after chemoradiotherapy in patients with rectal cancer.

B-0404 14:45

Differentiation of poorly differentiated colorectal adenocarcinomas from well- or moderately differentiated colorectal adenocarcinomas at contrast-enhanced multidetector computed tomography

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Purpose: To describe the CT findings of poorly-differentiated (PD) colorectal adenocarcinoma (CRAC) and to identify the features that differentiate it from well- (WD) or moderately-differentiated (MD) CRAC.
Methods and Materials: One-hundred and thirteen patients with pathologically proved PD (n = 26), WD (n = 35), or MD (n = 52) CRACs who had undergone preoperative contrast-enhanced multidetector CT (MDCT) imaging were included in this study. Analysis of CT findings included determination of the (a) location and shape of the tumour; (b) enhancement pattern and degree, and maximal wall thickness of the tumour; (c) pericolic fat infiltration; (d) size and enhancement degree of the regional lymph nodes (LNs); and (e) presence of direct invasion, colonic obstruction, and distant metastasis. The significance of these findings was determined with the x^2 test.
Results: ignificant features in the differentiation of PD CRACs from WD or MD CRACs included bulky shape, heterogeneous enhancement, the same or lower attenuation compared with muscle within the tumour, nodular pericolic fat infiltration, regional LNs being more than 10 mm in short axis diameter, regional LNs with the same or lower attenuation compared with muscle, and presence of distant metastasis ($P < 0.05$). When at least two of these seven imaging features were used in combination, sensitivity and specificity in the diagnosis of PD CRACs were 88% and 70%, respectively.
Conclusion: By using characteristic CT features, one can differentiate PD CRAC from WD or MD CRAC with a high degree of accuracy at contrast-enhanced MDCT.

B-0405 14:54

Comparison between CT with multiplanar reconstructions and MRI for prediction of neoadjuvant therapy in rectal cancer

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Purpose: The objective of this study was to compare the multidetector-row CT (MDCT) with multiplanar reconstructions and MRI in the decision of neoadjuvant therapy in rectal cancer.
Methods and Materials: During a 4-year period, all patients who were enrolled in this study had biopsy-proven rectal carcinoma, CT of the abdomen and pelvis and MRI of the pelvis. Two radiologists, an expert and a junior reviewed all examinations independently. They were blinded one from the other, from the findings of the other modality, and from clinical information. Only T3 tumours, staged using MRI by the expert were analysed. Agreement between MRI and MDCT, inter-observer agreement concerning neoadjuvant therapy decision and all tumor characteristics were calculated.
Results: Among the 62 studied patients, the neoadjuvant radiochemothrapy was indicated in 56 patients (90.3%). In the prediction of neoadjuvant radiochemotherapy by CT, the agreement between the two modalities was 0.73, the sensitivity was about 98%, the specificity was about 75%, the PPV was about 98% and the NPV was about 75%. Inter-observer agreement was 0.73 for the MRI and 1.00 for the CT. Agreement between MDCT and MRI was: for mesorectal fascia characteristics 0.73, for nodes status 0.53, for vascular invasion 0.19, for tumour deposit 0.48, for tumour spread into mesorectum 0.14, and for size 0.49. Inter-observer agreement were ranged from 0.40 to 1.00 for the CT and from 0.56 to 1.00.
Conclusion: Our findings suggest that MDCT with multiplanar reconstructions can replace MRI for the prediction of neoadjuvant therapy.

B-0406 15:03

Does tumour size matter? Correlation of rectal tumour volumes with oncological outcomes in low rectal cancers

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Purpose: The relationship between tumour volume and oncological outcome has been reported in cases of brain, nasopharyngeal, lung, hepatocellular and prostate cancers. There is paucity of similar data in rectal cancer. The aims of this study were to determine whether tumour volume and mesorectal volume evaluated by magnetic resonance imaging (MRI) have effects on oncological outcomes of rectal cancer.
Methods and Materials: Volumetric analysis of rectal tumours was performed from the MRI images and then correlated with oncological outcomes. The study was based on a clinical and radiological database of patients who underwent rectal cancer surgery in a tertiary teaching centre during the year 2004.
Results: 35 patients underwent rectal cancer surgery after staging with MRI during the study period. Of these, seven could not have their MRI images retrieved and were, therefore, excluded from further analysis. 3 further patients had metastases identified at diagnosis and were also excluded. Tumour volume (TV) was a significant predictor of overall survival HR (95%CI); 5.8 (1.2-29), (P=0.03). Mesorectal volume (MRV) and TV/MRV did not show any correlation with oncological outcomes. LNR, TME and inadvertent perforation were other independent predictors of oncological outcomes following APER.
Conclusion: Tumour volume showed a direct relationship with overall survival and this may be used to stratify rectal tumours for neoadjuvant therapy; however, a larger prospective study is required to prove this correlation.

B-0407 15:12

Preliminary study of low-tube voltage scan in evaluation of T-staging of rectal cancer with dual-source CT

G. Shi, Y.-N. Wang; *Shijiazhuang/CN (gaofengs62@sina.com)*

Purpose: The purpose of this study was to investigate the effect of low tube voltage in evaluation of T-Staging of rectal cancer with dual-source CT.
Methods and Materials: Forty patients (25 men ,15 women) underwent contrast-enhanced abdominal DSCT. Data were reconstructed as three groups: group A, fused image reconstructed with D30 (filter back projection FBP) ;group B, 80 kV image reconstructed with D30 and group C ,80 kV image reconstructed with I30 (iterative reconstruction IR). The mean CT numbers, noise and SNR of organs and lesions were assessed quantitatively in each group. Diagnostic accuracy was statistically compared related with pathologic staging between three groups.
Results: Noise of group A and C had no difference ($P > 0.05$), while lower than group B ($P < 0.05$). Mean CT value of external iliac vessels at group B and C had no difference ($P > 0.05$), while higher than group B ($P < 0.05$). SNR of external iliac vessels at group A and B had no difference ($P > 0.05$), while lower than group C ($P < 0.05$). Mean CT value of rectal cancer at three groups had no difference ($P > 0.05$), while SNR of rectal cancer at group A and C higher than group B ($P < 0.05$).The diagnostic accuracy of group A and C had no statistical difference ($P > 0.05$), while higher than group B ($P < 0.05$).
Conclusion: Obtained with 80 kV (with iterative reconstruction) is feasible and the images are satisfactory for T-Staging of rectal cancer.

B-0408 15:21

MR tumour volumetry for tumour response evaluation after neo-adjuvant chemoradiation- in rectal cancer: a prospective validation study

M.H. Martens, R.C. Dresen, D.M. Lambregts, L.A. Heijnen, T.J. Hua, W. Mok, G.L. Beets, R.G.H. Beets-Tan; *Maastricht/NL (milou.martens@mumc.nl)*

Purpose: The assessment of tumour response after chemoradiation (CRT) in rectal cancer remains difficult. Morphologic evaluation on T2-weighted MRI is not accurate to predict tumour downstaging. Studies have suggested that assessment of tumour volume may improve the accuracy, but this has only

been tested retrospectively. Aim of this study was to prospectively determine the value of tumour volumetry by testing previously reported volume thresholds in a new cohort of locally advanced rectal cancers treated with CRT.
Methods and Materials: Seventy-three patients with a cT3-4 locally advanced rectal tumour were included. Tumour volume (estimated as height x length x width) was analysed before and after CRT. The reduction in tumour volume (%) was calculated. The primary tumour volume and volume reduction after CRT was compared between responders (ypT0-2) and non-responders (ypT3-4) using Mann Whitney U test. Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were calculated using a predefined cut-off of > 75% reduction in tumour volume (according to previous reports).
Results: The volume of the primary tumour was significantly smaller in de ypT0-2 group compared to ypT3-4 tumours (97.0 vs 172.8 cm^3, p=0.008). Volume reduction rates were significantly higher in ypT0-2 than in ypT3-4 tumours (86.7 vs 72.4%, $p < 0.001$). Applying the criterium of > 75% reduction resulted in a sensitivity of 88%, specificity 59%, PPV 65%, and NPV 85% for detecting ypT0-2.
Conclusion: This study has prospectively confirmed that a reduction in tumour volume of > 75% MRI can predict tumour downstaging to yT0-2 with a high sensitivity and moderate specificity.

14:00 - 15:30 **Room B**

Abdominal Viscera

SS 601b

Efficacy and diagnostic performance

Moderators:
F. Caseiro-Alves; Coimbra/PT
S. Haneder; Mannheim/DE

B-0409 14:00

The correlation study of visceral fat area and non-alcoholic liver disease in hepatocellular carcinoma
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Purpose: Visceral fat area (VFA) is a quantitative measurement of visceral fat in CT images. Increased VFA has been postulated as the cause of non-alcoholic fatty liver disease (NAFLD) in NAFLD-related hepatocellular carcinoma (HCC). So far, no study has directly validated the hypothesis.
Methods and Materials: 43 HCC patients with pre-treatment abdominal CT in Jan/2009-April/2011, without chronic viral hepatitis or alcoholism, were included. VFA elevation (> 100 cm^2 at umbilicus level) and fatty liver is determined in CT images. Prevalence of increased VFA, liver function test (LFT) at HCC diagnosis, Child-Pugh score, the Cancer of the Liver Italian Program (CLIP) score, and HCC-related mortality were compared between patients with and without NAFLD. Further, CLIP staging was compared between patients with and without elevated VFA.
Results: No statistically significant difference existed in the prevalence of increased VFA, HCC-related mortality, Child-Pugh score and LFT at HCC diagnosis, between patients with and without NAFLD. The distribution pattern of CLIP score was statistically significantly different between NAFLD group and non-NAFLD group (more CLIP 2, 3 patients in NAFLD group, p=0.047) but not between HCC patients with and without VFA elevation. The mortality rate in non-NALFD group is higher than NAFLD group but not statistically significant (p=0.101).

Conclusion: The results from our study did not support that increased VFA was associated with LFT, severity of NAFLD, and several prognostic factors in HCC patients. The difference in mortality and distribution pattern of CLIP stage in patients with and without NAFLD suggested different prognoses and may worth further investigation.

B-0410 14:09

The use of bolus tracking, high flow or slow flow contrast injection rate in Gd-EOB-MRI of the liver and its influence on SNR and truncation artifacts on arterial phase
G. Perucca, P. Demaria, R. Faletti, D. Righi, P. Fonio, G. Gandini; *Turin/IT (giuliaperucca@yahoo.it)*

Purpose: To evaluate signal to noise ratio (SNR) and presence of truncation artifacts (TA) on arterial phase images in gadoxetic acid-DTPA (Gd-EOB-DTPA)-enhanced magnetic resonance imaging (MRI) of the liver with and without fluoroscopic triggering technique using high or slow-rate contrast injection.
Methods and Materials: 176 MR examinations for liver disease were retrospectively reviewed. Three Gd-EOB-DTPA injection methods were evaluated: 1) fluoroscopic triggering and high-rate injection (2.0 ml/s); 2) fluoroscopic triggering and slow-rate injection (0.8 ml/s); 3) no fluoroscopic triggering, high-rate injection and double arterial phase acquisition (2.5 ml/s). A qualitative analysis was performed, evaluating presence of TA and giving a score to set the image quality (0: no TA; 1: TA with no diagnostic impairment; 2: TA with diagnostic impairment). As a quantitative analysis, SNR ratio on arterial phase images was calculated placing ROIs in three liver parenchyma regions. To evaluate the appropriateness of the arterial phase, mean intensity values were calculated on abdominal aorta, and compared to values in non-enhanced phase. T-Student test and ANOVA test were performed for statistical analysis.
Results: The presence of TA was significantly lower in groups 2 and 3 if compared to group 1. SNR of liver parenchyma on arterial phase was significantly higher in groups 2 and 3, in comparison with group 1. The appropriateness of the arterial phase was similar across groups.
Conclusion: High rate contrast injection without fluoroscopic triggering technique and double arterial phase acquisition is a valid choice for Gd-EOB-DTPA MR imaging of the liver.

B-0411 14:18

Usefulness of "controlled aliasing in parallel imaging results in higher acceleration" (CAIPIRINHA) in gadoxetic acid-enhanced liver MRI to clarify the hepatic arterial phase
Y. Park, C. Lee, K. Kim, J. Choi, J. Lee, C. Park; *Seoul/KR (pys797979@naver.com)*

Purpose: To determine whether CAIPIRINHA could improve the image quality in the hepatic arterial phase of gadoxetic acid-enhanced liver MRI.
Methods and Materials: A total of 320 patients underwent gadoxetic acid-enhanced liver MRI: a conventional protocol (fixed scan delay and 2 mL/s injection) using standard 3-T MR (group A); an optimised protocol (bolus tracking and 1 mL/s injection) using standard 3-T MR (group B); an optimised protocol using new 3-T MR (group C); and an optimised protocol and CAIPIRINHA using new 3-T MR (group D). An image quality in the hepatic arterial phase was reviewed and assigned using a 4-point rating scale from 1 (no artifacts) to 4 points (nondiagnostic images with severe artifacts). The differences in image quality scores among 4 groups were evaluated.
Results: The median score of image quality was 2 in groups A and B and 1 in groups C and D. Scores of 4 points were observed in groups A (n = 7), B (n = 5), and C (n = 3), but not in group D. From groups A to D, the median score of image quality decreased significantly ($P = 0.0001$). The median score of image quality of group D was significantly lower than those of groups A and B ($P = 0.0001$ and 0.001, respectively), while there was no significant difference between groups D and C ($P = 0.656$).
Conclusion: CAIPIRINHA technique improved the image quality of hepatic arterial phase imaging with gadoxetic acid, reducing the number of nondiagnostic arterial phase studies.

B-0413 14:27

Real-time elastography: role in the assessment of hepatic fibrosis in patients with liver iron-overload
L. Cevasco, F. Paparo, M. Revelli, C. Puppo, E. Aleo, L. Bacigalupo, G. Forni, G. Rollandi; *Genoa/IT (dott.luca.cevasco@gmail.com)*

Purpose: Our purpose was to determine the diagnostic accuracy of real-time elastography (RTE) in assessing hepatic fibrosis stage in a heterogeneous cohort of patients with liver iron-overload using transient elastography (TE) as reference standard.
Methods and Materials: 67 patients with MRI-detectable hepatic iron-overload (T2*< 6.3 ms) were enrolled. All TE and RTE examinations were performed by experienced operators: the informations provided by the elastograms were converted in quantitative data by calculating the elastic ratio, which represents the strain distribution in two selected ROI (one positioned in the liver parenchyma and the other in a homogeneously soft region of the diaphragm).
Results: 60 patients were included; 7 patients were excluded because of invalid TE or RTE examinations. The cohort of patients included 37 adults with thalassaemia major, 13 patients with thalassaemia intermedia, 6 patients with primary haemochromatosis and 4 patients with myelodysplastic syndromes. A significant increase in elastic ratios was observed with increasing stiffness values measured by TE ($r=-0.645$, 95% CI 0.468-0.772, $P < 0.0001$). The mean elastic ratios for each METAVIR group were as follows: F0/1=1.9±0.4; F2=2.2±0.4; F3=2.9±0.5; F4=3.2±0.4. The diagnostic accuracy of RTE for F≥2 evaluated by AUC-ROC analysis was 0.798 (95% CI 0.674-0.890). The diagnostic accuracy of RTE for F≥3 was 0.909 (95% CI 0.806-0.968). At a cut-off ≥2.75, RTE showed a sensitivity of 70% (95% CI 45.7-88.1) and a specificity of 97.5% (95% CI 86.8-99.9).
Conclusion: RTE allows to discriminate between F0/1-F2 and F3-F4 with a reasonable diagnostic accuracy in patients with MRI-detectable liver iron-overload.

B-0414 14:36

The impact of field strength and contrast administration on liver haemodynamics at k-t accelerated 4D flow MRI

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Purpose: To evaluate influence of contrast administration and field strength on visualisation and quantification of arterial and portal venous (PV) liver haemodynamics at 4D flow MRI in healthy volunteers.
Methods and Materials: Liver haemodynamics were evaluated on n=38 4D flow MRI datasets acquired in 5 healthy volunteers (55±9 yrs) at 1.5 T and 3 T with a spatial resolution of 2.1x2.5x3.0 mm^3. Scans were performed before and after administration of gadofosveset trisodium (Ablavar©). Measurements were performed with venc=50 and 100 cm/sec. K-t GRAPPA was applied with an acceleration factor R=5. Qualitative 3D blood flow visualisation was based on particle-traces and streamlines. Quantitative analyses were performed with retrospective extraction of time-resolved peak velocities and net flow over the cardiac cycle based on 10 analyses planes. Bland Altman (BA) analyses compared peak velocities and net flow.
Results: 4D flow MRI visualisation was successful in all datasets. Qualitatively, increased noise was seen for the PV system evaluation for a venc of 100 cm/s. Quantitative analyses at 1.5 vs. 3 T revealed similar values for peak velocities (BA:0.02±0.12 cm/s) and net flow (BA:0.2±3.4 ml/cycle). Flow quantification before and after contrast offered similar values for peak velocities (BA:0.01±0.05 cm/s), while net flow values were increased with a mean difference of (BA:-0.6±1.3 ml/cycle) post-contrast.
Conclusion: 4D flow MRI enables visualisation of the liver haemodynamics, at both 1.5 and 3 T, with and without contrast. While quantitation of peak velocities was similar across field strengths and independent of contrast administration, statistically significant differences were noted in net flow quantification, likely due better delineation of vessel margins with contrast.
Author Disclosures:
J. Carr: Speaker; Lantheus Speaker Bureau.

B-0415 14:45

Diagnostic capabilities of dual-energy x-ray absorptiometry in the diagnostic algorithm of the metabolic syndrome in patients with steatohepatitis

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Purpose: To determine the informational content of x-ray absorptiometry and non-invasive bioimpedance in patients with mixed origin steatohepatitis.
Methods and Materials: In 2012, 63 patients with obesity were examined (men - 38 women - 25) with steatohepatitis: Group 1 (n = 18) - non-alcoholic fatty liver disease, group 2 (n = 21) - steatohepatitis in patients with 2-type diabetes, group 3 (n = 24) - alcoholic steatohepatitis. The patients underwent a bioimpedance and the whole body research with dual energy absorptiometry (DXA-StratosDR).
Results: At the 1st stage, the body mass index (BMI), the results of bioimpedance and densitometric analysis in the system "fat - water" and "fat - lean mass" of the human body were compared. The diagnostic efficacy of instrumental methods is 38.6 % higher than BMI information content in all patients. On the 2nd stage, the set of measures to reduce weight was hold. In the first month of the 2nd stage, with DXA and BIM the water sector of the organism was decreased in 1 gr. by 18.5 % of the original; in 2 gr. by 27.1%; in 3 gr. by 7.8 %. DXA in 2nd stage: sensitivity 97.5%, specificity 95.2%; informative content of BIM was: sensitivity 74.7%, specificity 66.3%.
Conclusion: The method for DXA-"whole body" is more informative in the diagnosis of metabolic syndrome.

B-0416 14:54

MRI-based estimation of liver function: post-Gd-EOB-DTPA T1 relaxometry of 3 T vs the MELD-Score

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Purpose: To determine the ability of T1 mapping of liver on Gd-EOB-DTPA-enhanced MR imaging (MRI) for estimating liver function and to compare the estimated liver function to the Model for End-Stage Liver Disease (MELD) score.
Methods and Materials: 168 patients underwent Gd-EOB-DTPA-enhanced MRI on a 3 T system. Patients were classified into three groups: MELD-Score ≤ 10 (n = 128), MELD-Score 11 - 18 (n = 33) and patients with MELD-Score > 18 (n = 7). Two TurboFLASH sequences (TI = 400 ms, 1000 ms) were acquired before and 20 minutes after Gd-EOB-DTPA administration to obtain T1 maps. Reduction rate of T1 relaxation time between pre- and postcontrast enhancement and T1 relaxation times were determined and correlated to the MELD-score.
Results: T1 relaxation time for non-enhanced MRI showed no significant differences (p = 0.644) between the 3 different groups (MELD ≤ 10, 762.62 ms ± 140.28 ms; MELD 11- 18, 783.31 ms ± 169.47; MELD > 18, 802.11 ms ± 204.14 ms). After administration of Gd-EOB-DTPA a significant difference of patient groups could be shown (MELD ≤ 10, 297.72 ms ± 88.41 ms; MELD 11- 18, 430.16 ms ± 134.99; MELD > 18, 561.95 ms ± 90 ms; p ≤ 0.001)
Conclusion: Patients with advanced liver disease showed significantly lower changes in T1 mapping. Therefore, evaluation of changes in T1 mapping of the liver parenchyma may serve as a useful method to determine whole liver function, to improve the estimation of segmental liver function and finally to define the grade of liver disease.

B-0417 15:03

The application research of CT single energy image fusion technology in hypervascular liver small lesions

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Purpose: To evaluate the applied value of CT single energy image fusion technology in hypervascular liver small lesions in arterial phase.
Methods and Materials: 30 patients who were accepted energy spectra of CT scans in arterial phase, a total of 48 small rich blood supply of the liver lesions (< 3 cm), were retrospectively analysed. CT browser binding energy spectrum, yielding 40keV, 70keV, QC groups, as well as (40+70) keV integration set of four images. The noise ratio (CNR) and image noise of four groups were compared using one-way analysis of variance. The lesion detection and the overall image quality were compared using 5 point method and using nonparametric tests.
Results: There were no significant differences between the CNR of (40+70) keV group (6.39 ±4.21) and that of 40keV Group (4.15 ±3.97) (P> 0.05), but the CNR of (40+70) keV group was significantly higher than that of 70keV Group (3.28 ±3.02) (p=0.009) and that of QC group (3.23 ±3.41) (p=0.008).The image noise of (40+70) keV group (25.44 ±6.74) is significantly lower than that of 40keV (46.37±9.16) (P < 0.001), but higher than that 70keV Group (19.33±6.70) (P=0.009) and QC group (16.61±3.60) (p < 0.001). There were no significant differences between the lesions detection capacity score of (40+70) keV group (3.36 ± 0.51) and that of 40keV Group (3.5 ± 0.66), but the lesions detection capacity score of (40+70) keV group was significantly higher than that of 70keV Group (2.94 ± 0.45) (P=0.016) and that of QC group (3.06 ± 0.416) (P=0.049). The overall image quality score of the (40 +70) keV group (3.61 ± 0.53) was significantly higher than that of the other three group (P < 0.02).
Conclusion: CT single energy image fusion technology which combines the advantages of high CNR of the low keV image with the advantages of the low noise of high keV image without compromising image quality, improve the lesion detection capability.

B-0418 15:12

Cost-utility analysis of nonalcoholic steatohepatitis screening

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Purpose: Nonalcoholic fatty liver disease (NAFLD) is the leading chronic liver condition in Western countries. No studies have examined the cost-effectiveness of screening for nonalcoholic steatohepatitis (NASH), its advanced form. We performed a cost-utility analysis of noninvasive screening and intervention strategies using third-party payer perspective.
Methods and Materials: A Markov model was created simulating NAFLD progression in a general population. We compared the most validated noninvasive techniques for NASH or significant fibrosis (≥F2) detection: transient elastography (TE); acoustic radiation force impulse (ARFI); NAFLD fibrosis score (NFS); cytokeratin-18 (CK-18); magnetic resonance elastography (MRE), and sequential algorithms. Liver biopsy and MRE were compared as confirmation methods. Model parameters were derived from literature review and uncertainties tested in sensitivity analyses. Costs were calculated in Canadian dollars adjusted for inflation and discounted at 3%. Incremental cost-effectiveness ratio (ICER) of $C50,000 or less was considered cost-effective.
Results: Compared with no screening, screening with NFS alone and with NFS/TE/CK-18 algorithm were most cost-effective with ICERs of $C4,330 and $C18,200 per quality-adjusted life year (QALY) gained, respectively. Screening with NFS/ARFI/CK-18 algorithm was dominated with an ICER of $C61,876 per QALY gained. Compared with biopsy, MRE confirmation for fibrosis staging was more cost-effective with ICER of $C18,715 vs. $C44,033. Sensitivity analyses revealed ARFI became more cost-effective than TE in the sequential algorithms if TE unreliability rates exceeded 21% or when TE price increased past $C108.
Conclusion: Our model suggests that NASH screening in the general population can be cost-effective with NFS alone or with a sequential NFS/TE/CK-18 algorithm.

14:00 - 15:30 **Room C**

Computer Applications

SS 605
CAD and image segmentation

Moderators:
O. Pianykh; Newton Highlands, MA/US
P. Sögner; Feldkirch/AT

B-0419 14:00

Double reading improves detection of small lung tumours in chest radiographs: can a computer aided detection system replace the second reader?

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Purpose: To investigate whether or not a computer aided detection (CAD) system could replace a second human reader in a double reading process.
Methods and Materials: We selected 300 posteroanterior and lateral digital chest radiographs (CXR), including 111 with a solitary CT proven pulmonary nodule with an average diameter of 16 mm. Twelve radiologists read the CXRs having bone suppressed images available. Readers marked and scored suspicious regions on a continuous scale from 0 to 100. All images were also processed by a CAD system (ClearRead+Detect 5.2, Riverain Technologies) that also provided a score between 0 and 100 for each suspicious location it identified. Location based ROC analysis was used to measure nodule localisation performance. Mean sensitivity in a false positive fraction range between 0 and 0.2 was used to compare reader performance. Double reading was evaluated by combining the findings of two readers: scores of findings at the same location were averaged while findings that were not identified by the second observer were averaged with 0. CAD results were treated similarly to every observer for simulated double reading. A paired t-test was used to calculate differences.
Results: The mean sensitivity was 64.0% for single reading (range 45.5%-78.2%). Combining the readings of two observers improved lung nodule detection on average to 73.1% (range 58.3%-83.8%; p=0.001). Performance with CAD as the second reader increased to 67.8% (range 58.1%-81.1%; p=0.02).
Conclusion: Use of CAD as the second reader significantly improves detection of lung nodules, although it is not yet as good as double reading by two human readers.
Author Disclosures:
S. Schalekamp: Research/Grant Support; Riverain Technologies. **C.M. Schaefer-Prokop:** Advisory Board; Riverain Technologies. **N. Karssemeijer:** Research/Grant Support; Riverain Technologies.

B-0424 14:09

Visceral fat quantification using routine abdominal CT data

M. Pop, R. Pop; *Tg.Mures/RO (pop.marian@gmail.com)*

Purpose: Quantitative assessment of body fat is important for the diagnosis and treatment of diseases related to obesity. The standard evaluation methods do not measure body fat quantitatively. Computed tomography (CT) is becoming the standard procedure for measuring the abdominal fat distribution, various methods and software being used.
Methods and Materials: The retrospective study included 111 inpatients, who underwent routine abdominal CT exams (SOMATOM AS 64 MDCT). MPR linking the posterior-inferior aspect of L4/L5 intervertebral disc and the umbilicus were processed using custom written MATLAB R2009b software. ImageJ was used for tracing the contour of visceral fat area (VFA).Patient data (including blood glucose, cholesterol and triglycerides) were statistically analysed using MO Excel and GraphPad Inprism5.
Results: The Visceral Fat percentage varied in population from 14.59-68.69 (SD= 11.83) with significant difference between sexes (male vs. female, 46.98vs.31.62, p 220 mg% and triglycerides $>$ 150 mg% are significantly associated with the VF percent ($p < 0.05$).Overall there is a weak correlation between the lab variables and the measured fat, the strongest one being between TG and the VFA (r=+0.23). However, when looking at certain samples there is a higher positive correlation between age and VFA percentage.
Conclusion: The technique used decreases the human error in marking of the fat areas providing a good estimation of the VF and VF percentage. Visceral fat measured by CT relates with certain lab variables. Further analysis, including different blood tests and clinical data are required for a better understanding of the CT role in obesity related pathology diagnosis and treatment.

Author Disclosures:
M. Pop: Grant Recipient; Internal Research Grant- Tg.Mures University of Medicine and Pharmacy, Romania. **R. Pop:** Grant Recipient; Internal Research Grant- Tg.Mures University of Medicine and Pharmacy, Romania.

B-0420 14:18

Application of artificial neuronal networks for the assessment for the assessment of early, non-invasive breast cancer

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Purpose: Accurate diagnosis of breast cancer at an early, non-invasive stage is crucial for favourable patient outcome. Breast-MRI provides significant potential to solve this task. However, even upon breast-MRI differentiation of non-invasive breast cancer from benign fibrocystic breast changes remains challenging. Artificial neuronal networks (ANN) are able to automatically classify highly sophisticated imaging data. Accordingly, we evaluated the potential of ANN for the diagnosis of early, non-invasive breast cancer based on MRI imaging patterns.
Methods and Materials: Patients were recruited from a cross-sectional database containing consecutive, histologically verified breast lesions imaged by breast-MRI (standardised protocols; ethical-board approval). All non-invasive breast cancer (DCIS: ductal carcinoma in situ) or benign findings (FBC: fibrocystic breast changes) were included into the dataset of the study. In a next step, imaging patterns of FBC and DCIS were prospectively evaluated by two experienced radiologists in consensus using 17 standardised descriptors. Finally, non-supervised ANN were applied to classify each lesions as "benign" or "malignant" based on the breast-MRI descriptors. To further optimise the ANN performance, topology and network-architecture were optimised using dedicated heuristics in a randomly selected training sample. Diagnostic accuracy of the ANN was then prospectively evaluated in a separate test sample (AUC: Area under the curve).
Results: 288 patients were included into the dataset. 69 were diagnosed with DCIS. Diagnostic accuracy was highest, if a multilayer perceptron type ANN was used (AUC= 86.2%).
Conclusion: Artificial neuronal networks provide high diagnostic accuracy for the assessment of breast cancer at an early non-invasive stage.

B-0421 14:27

Real time and accurate segmentation of mammographic microcalcifications

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Purpose: Morphology of individual microcalcifications contributes in the characterisation of microcalcification clusters in mammography. Precise segmentation is thus essential for the development of computer-aided diagnosis (CAD) schemes. The purpose of this study is the development of a method for fast and accurate segmentation of individual microcalcifications, fulfilling requirements of a content-based image retrieval CAD scheme.

Methods and Materials: A two-stage segmentation method was developed. Initially, the grey-level value corresponding to the maximum radial gradient index (RGI) is estimated in polar coordinates, providing initial contour pixel estimates. The RGI contour is then defined in Cartesian coordinates using a first-order polynomial fitting of the contour pixel estimates. Finally, the contour is optimised by iterative region growing, allowing curve evolution from inside the lesion. The proposed method was compared with a radial gradient-based segmentation method. Segmentation accuracy was quantitatively evaluated employing the area overlap measure, by comparing automated segmentations to expert manual delineations of 158 individual microcalcifications originating from 24 clusters of the DDSM database. Microcalcifications spanned a wide range of shapes and sizes and background mammographic parenchyma. The method functionality was qualitatively assessed by incorporating it in a home-developed GUI.
Results: The proposed method achieved an area overlap of 0.66 ± 0.20, outperforming statistically significantly ($p < 0.001$) the radial gradient-based method (0.44 ± 0.17), and fulfilled radiologists' requirements for accurate and real-time segmentation of microcalcifications.
Conclusion: The proposed segmentation method is time-efficient and non-parametric, performing accurately in case of microcalcifications of varying shape and size, even in presence of dense parenchyma.

B-0422 14:36

Automatic detection of prostate cancer by computer-aided multi-parametric magnetic resonance imaging

S. Mazzetti, V. Giannini, A. Vignati, F. Russo, D. Regge, M. Stasi; *Candiolo/IT*

Purpose: A computer-aided diagnosis (CAD) system was developed, to increase objectivity and reproducibility of prostate cancer (PCa) interpretation in multi-parametric (mp) magnetic resonance imaging (MRI). T2-weighted (T2-w), diffusion-weighted (DW) and dynamic contrast-enhanced (DCE) parameters were combined to calculate a pixel-wise probability of PCa presence.
Methods and Materials: 20 men with PSA> 4 ng/ml with biopsy proven PCa underwent MRI at 1.5 T using an endorectal coil, followed radical prostatectomy within 3 months of imaging. Each prostate was cut into axial sections of the same thickness and orientation as the axial MRI. Foci of cancer were contoured on each slide with ink by the pathologist to create the standard of reference. A radiologist compared imaging with histopathology and reported both malignant and benign regions of interest on T2-w images. After the registration between T2-w, DW and DCE datasets, each pixel was represented like a vector containing scalar values such as T2-w signal intensity, the apparent diffusion coefficient and quantitative physiological parameters (e.g. kep, Ktrans) obtained from DCE-MRI datasets. All these parameters were fed into a support vector machine (SVM) classifier, and a parametric color-coded map of the cancer's presence probability for each pixel of the prostate was created.
Results: The area under the ROC curve for the SVM classifier was equal to 0.93, sensitivity 0.84 and specificity 0.85.
Conclusion: The application of a CAD system based on MRI information that automatically highlights cancer suspicious regions will improve the diagnostic accuracy of the radiologist, reducing reader variability and speeding up the reading time.

B-0423 14:45

Automatic segmentation of atherosclerotic plaque components in different carotid MRI protocols

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Purpose: To automatically segment carotid atherosclerotic plaque components in MR image data from two hospitals with a difference in MRI pulse sequences and MRI scanners. Additionally, to evaluate whether a method trained on data obtained with one imaging protocol can be used to segment data that is obtained with another protocol.
Methods and Materials: Multi-sequence MRI (T1w, T2w, IR-TFE or SPGR, TOF or FSPGR, postcontrast-T1w) of 19 patients from center 1 and 20 from center 2 (stenosis 30-69%) were acquired. Observer 1 manually annotated all 39 images; observer 2 only those of center 1. Using the annotations of observer 1, linear discriminant classifiers for calcification (C), lipid or intraplaque haemorrhage (L+IPH) and fibrous tissue (F) were trained with 2 methods: M1) using only same-center data and M2) using only different-center data. Evaluation was performed using leave-one-patient-out experiments.
Results: ICC-values (volume per vessel) of F, L+IPH and C, were for M1 0.98, 0.90 and 0.60 (center-1) and 0.96, 0.91 and 0.94 (center-2), and for M2 0.87, 0.89 and 0.09 (center-1) and 0.97, 0.94 and 0.81 (center-2). Interobserver-ICC for center 1 was 0.91, 0.53 and 0.63. Kappa for IPH-detection was 0.80 and 0.89 (M1), 1.00 and 0.71 (M2), and 0.78 between observers.

Conclusion: Automated segmentation of atherosclerotic plaque components was similar to the interobserver variability. Using an algorithm trained on data from a different center reduced accuracy for calcification and, for center 2, IPH detection. Either standardised imaging protocols, or advances in image processing to deal with different image acquisitions, are recommended.
Author Disclosures:
A. van Engelen: Research/Grant Support; CTMM, the Center for Translational Molecular Medicine (www.ctmm.nl), project PARISk (grant 01C- 202), and the Dutch Heart Foundation. **A.C. van Dijk:** Research/Grant Support; CTMM, the Center for Translational Molecular Medicine (www.ctmm.nl), project PARISk (grant 01C- 202), and the Dutch Heart Foundation. **M.T.B. Truijman:** Research/Grant Support; CTMM, the Center for Translational Molecular Medicine (www.ctmm.nl), project PARISk (grant 01C- 202), and the Dutch Heart Foundation. **R. van 't Klooster:** Research/Grant Support; CTMM, the Center for Translational Molecular Medicine (www.ctmm.nl), project PARISk (grant 01C- 202), and the Dutch Heart Foundation.

B-0425 14:54

Computer-assisted diagnosis (CAD) in multiparametric neuroimaging: you only have to push the button?

M. Dietzel[1], S. Lang[1], P.A.T. Baltzer[2], B. Volbers[1], S. Lettmaier[1], R. Fietkau[1], T. Struffert[1], T. Engelhorn[1], A. Dörfler[1]; [1]*Erlangen/DE*, [2]*Vienna/AT*

Purpose: Multiparametric magnetic-resonance neuroimaging is increasingly used in clinical practice. From theory, it provides quantitative measures for tissue characterisation and might - beside many other benefits - potentially reduce observer related bias. Yet, currently available CAD-software requires numerous user-interactions. Consequently, relevant observer-related bias on final results can not be excluded. We aimed to systematically address this matter using a state of the art MR protocol and a CAD-software, specifically designed for this purpose.
Methods and Materials: A series of fifteen patients with brain tumours was investigated using one clinical MR unit (Siemens Magentom Aera, B_0=1.5T) including DTI (Diffusion tensor imaging), DWI (Diffusion weighted imaging) as well as DCE sequences (dynamic contrast enhanced; 6 ml Gadovist @2 ml/s). Multiparametric analysis was done by one experienced neuroradiologist using a commercially available semi-automatic CAD-software. Postprocessing was repeated independently several times resulting in serial measurements of FA (DTI), ADC (DWI), k^{trans}, k^{ep} and V_e (DCE). Variability within serial measurements was assessed by reproducibility (concordance correlation-coefficient), precision (Pearson ρ), accuracy (Bias correction-factor/Cb), reliability (intraclass correlation-coefficient) and systematic bias (Bland-Altmann plot: regression-coefficient/Rc).
Results: Overall variability of multiparametric analysis was low. Reproducibility, precision, reliability and accuracy showed a range from 0.94 to 0.99. Best results were identified for DCE-parameters (reproducibility, precision, reliability and accuracy: 0.99). In all series, Bland-Altmann plot excluded presence of systematic bias.
Conclusion: Computer-assisted multiparametric Neuroimaging was a robust measure for tissue characterisation. Despite significant user interaction during the CAD-analysis, we identified excellent reproducibility, precision and absence of systematic bias.

B-0426 15:03

An enterprise class computer aided detection platform scalable from laptop to cloud

M. Hinton[1], O. Kubassova[1], M. Boesen[2]; [1]*London/UK*, [2]*Copenhagen/DK (mark.hinton@imageanalysis.org.uk)*

Purpose: To achieve efficiency in analyzing medical images many utilise cloud based image storage and computer aided detection (CAD) techniques. The problem is keeping calculations and image overlays up to date whilst providing good user experience across uncontrolled bandwidths. To support clinical developments the architecture of the software should support easy integration of new algorithms without compromising performance. Here is a novel approach to a multi-tier architecture, Dynamika, which has addressed these problems and been validated in radiology practices.
Methods and Materials: Dynamika uses a back end framework of Spring and Hibernate to give robust server scaling and performance. It uses Spring Webflow to control the path through the application. Webflow has been enhanced for tightly controlled batch processing, utilised in clinical trials, routine analysis, and investigations. The front end uses Google Web Toolkit to give high performance, desktop like behavior through AJAX and the power of HTML5. 3D is with WebGL.

Results: We have benchmarked against a workstation for user experience and development efficiency. The cloud architecture has comparable performance to the workstation in scrolling through images with complex overlays. Time to implement new algorithms (coding and testing) was up to 10 times less in Dynamika. Dynamika supports collaboration and can be used from any device.
Conclusion: Dynamika has addressed challenges of handling large datasets in real-time. Validation in clinical practice has shown Dynamika gives better performance than a workstation. It supports multi-center collaboration and data sharing. There are low costs to deploy updates and development time is less.

Author Disclosures:
M. Hinton: Employee; Image Analysis. **O. Kubassova:** CEO; Image Analysis. **M. Boesen:** Advisory Board; Independant non paid member Image Analysis LTD. Consultant; Radiologist.

B-0427 15:12

Automatic assessment of the occlusal plane on panoramic radiographs.
P.A. Regulski, K. Szopiński, K. Nowiński; *Warsaw/PL (pregulski@interia.pl)*

Purpose: Objective assessment of the curvature of occlusal plane with the use of an automatic computer algorithm.
Methods and Materials: 100 panoramic radiographs were selected and divided by two observers into two equinumerous groups (Kappa = 1): a correct occlusal plane position (x-ray meets quality criteria) and an incorrect occlusal plane position (x-ray does not meet quality criteria). The segmentation algorithm based on clustering methods with adaptive thresholding was performed to find region of interest (teeth and space between them). This region constituted starting points for watershed segmentation. Skeletonization was carried out on segmented surfaces. Lines and points of the skeleton were smoothed with polynomial interpolation. For each x-ray, parametric angle of occlusal plane was calculated by using the mean of the derivatives in equidistant points located on the interpolated line.
Results: Magnitudes of parametric angles formed two Gaussian curves: one for panoramic radiographs meeting quality criteria (average = 15.97, standard deviation = 7.81), the other for ones the does not (average = 28.96, standard deviation = 9.21). By that means the thresholding value was obtained (α = 22.83, $p < 0.05$).
Conclusion: Automatic assessment of the curvature on orthopantomograms of occlusal plane is feasible and the objective thresholding value of this curvature is 22.83.

B-0428 15:21

Enhancing ground glass nodule interpretation through the interactive unification of 2D and 3D visualisations
P. Kocsis, V. Demers, F. Chandelier, L.A. Stein; *Montreal, QC/CA (virginie.demers@mail.mcgill.ca)*

Purpose: To demonstrate the advantage of a Novel visualisation technique that interactively blends 2D and 3D renderings for the interpretation of ground glass opacity nodules (GGO). We hypothesise that using such technique for GGO examination will allow an improvement in image accuracy in terms of diagnostic information when compared to traditional thick-slab multiplanar visualisation (SLAB).
Methods and Materials: 13 patient datasets were obtained from The Cancer Imaging Archive (http://cancerimagingarchive.net/) sponsored by the Cancer Imaging Program, DCTD/NCI/NIH. Interactive screen capture images of nodules were collected for both visualisation paradigms. Our primary objective was to evaluate the discriminative power of light intensity values within a given region of interest to best segregate GGO from its environment. The signal to noise ratio (SNR) was determined for all images and compared to a Rose Criterion (RC) that represents the 100% certainty threshold for identification of image details (corresponding to RC (SNR) ≥ 5).
Results: The SNR of GGO exceeded the Rose Criterion (SNR ≥ 5) in 92.3% and 46.2% of the patient datasets during the Novel and SLAB visualisation conditions respectively. Qualitative inspection of the GGO in the former ensured that vessels were not included in nodule volume assessments.
Conclusion: The Novel visualisation technique increases accuracy of image details, by providing an interactive environment integrating traditional SLAB visualisation and advanced 3D rendering. This facilitates radiologist's interpretation while characterising GGO nodules. Such results will be investigated during a prospective clinical study.
Author Disclosures:
P. Kocsis: Employee; Cadens Medical Imaging. **F. Chandelier:** Employee; Cadens Medical Imaging.

14:00 - 15:30 **Room D**

Chest

SS 604

Radiation dose and techniques in chest CT

Moderators:
P. Vock; Spiegel/CH
N.N.

B-0429 14:00

Are chest radiographs outdated in tuberculosis screening? Low dose CT (LDCT) as an alternative
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Purpose: To rule out tuberculosis before initiation of immunosuppressive therapy with biologicals, chest X-ray (cXR) is routinely used in rheumatic patients. We evaluated the diagnostic value of cXR in the detection of pleural scarring (PS) and postspecific changes (PC) compared to Low-Dose-CT (LDCT) of the chest as gold standard.
Methods and Materials: We retrospectively included 80 patients having erect cXR and LDCT of the chest performed within 2 weeks between 2009 and 2013. One blinded radiologist evaluated the presence/absence of PS and PC in LDCT independently from a second blinded radiologist who evaluated the cXR. Cohen´s kappa, Sensitivity (SN), specificity (SP), positive predictive value (PPV) and negative predictive value (NPV) and accuracy (AC) were calculated. Dose parameters were recorded.
Results: For detection of PS cXR resulted in SN, SP, PPV, NPV and AC of 53.7%, 96.6%, 92.3%, 27% and 77.9%, respectively. For detection of PC cXR resulted in SN, SP, PPV, NPV and AC of 50%, 98.3%, 90%, 86.6% and 87%, respectively. Agreement between cXR and LDCT was moderate with a Cohen's kappa value of 0.53. The average effective dose was 0.08 mSv in XR and 0.55 mSv in LDCT.
Conclusion: Our study showed that a substantial number of PC and PS are missed on conventional chest X-rays which might pose a potential risk for patients receiving immunosuppressive therapy. LDCT can reveal such post-specific changes at acceptable radiation dose and might therefore be an alternative imaging method to rule out postspecific changes.

B-0430 14:09

Thoracic lymph node delineation at contrast-enhanced MDCT: comparison of protocols with greatly reduced dose (< 1mSv) and standard dose
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Purpose: To determine differences in the delineation of mediastinal and hilar lymph nodes at contrast-enhanced MDCT between a dose-reduced (< 1mSv, LDCT) and a standard-dose (SDCT) protocol.
Methods and Materials: Based on the international-association-for-the-study-of-lung-cancer (IASLC) grouping of thoracic lymph nodes, two independent radiologists (respective post-graduate work experience, 3 and 20 years) retrospectively assessed lymph-node delineation ("measurable" vs. "non-measurable") in intravenously contrast-enhanced (average, 70 ml at 3 ml/s, with 350 mg-of-iodine/ml) MDCT-scans of the chest (64 rows, 120KVp, dose modulation, filtered back projection, reformatted axial slice thickness, 5 mm), including 9 subsequent LDCTs (effective-tube-current-time-product, < 30 mAs/slice, effective-dose, < 1mSv) and 36 matched SDCT controls (average, 100 mAs/slice, with matching for gender, age, chest/lung diameters, and clinical history) that were obtained during the 4th quarter, 2012. Fisher's exact test ($p < 0.05$) and Cohen's kappa statistics were applied.
Results: Inter-observer agreement was substantial to perfect (kappa: 0.75 - 1.0) for all thoracic lymph node groups (upper mediastinal, aortopulmonary, subcarinal, lower mediastinal, hilar, peripheral). Overall, LDCTs delineated 47 of 54 (87%) lymph node groups (positive inter-observer agreement), while SDCT delineated 174 of 216 (81%). There were no significant differences in individual lymph node groups (p=0.08 to 1.0). Measurable lymph nodes did not differ significantly in size between cases and controls.
Conclusion: Delineation of mediastinal and hilar lymph node groups was similar despite greatly reduced-dose at LDCT of the chest-CT when compared with standard dose chest-CT. Patients with non-malignant lung disease, unclear chest-X-ray findings, or the need for follow-up CT scans may therefore benefit from contrast-enhanced LDCT.

B-0431 14:18

Model based iterative reconstruction: its efficacy in CT assessment of cystic fibrosis and dose reduction

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Purpose: There is lack of a precise correlation between the chest radiographic (CXR) findings and the clinical manifestations of cystic fibrosis (CF). CT chest is contrarily more sensitive and specific, but routine use is limited by higher radiation dose (RD). Recent advent of the CT model-based iterative reconstruction (MBIR) technique improves low contrast detectability and reduces artifacts at significantly lower radiation dose. This prospective study was to evaluate the efficacy of MBIR in CT assessment of cystic fibrosis at much reduced RD.
Methods and Materials: CT chest at 100 kVp and 4 mAs were undertaken on consecutive acute adult CF patients. RD's were recorded. MBIR was used to produce CT images in standard formats. These images and CXR were individually read by 2 blinded radiologists. Results were compared.
Results: 82 patients (M:F=35:47, mean age of 34) were recruited. 29.3% patients had follow-up CT's. Images were generally 'noisy' but adequate. The RD's ranged between 0.042 to 0.07mSv which were comparable to one chest x-ray dose. CT demonstrated bronchiectasis and peribrochial thickening in 100%, mucous plugging in 82.9%, consolidation and tree-in-bud appearances in 54.8%, collapse in 4.8%, scarring in 42.6%, pneumothorax in 1.2% and pulmonary abscess in 3.65% of these patients. CXR only detected 68.3%, 4.9%, 14.6%, 1.2%, 24.3%, 1.2% and 0% of these abnormalities correspondingly. Follow-up CT's accurately monitoring abnormalities.
Conclusion: Gene therapies being developed for CF require detailed lung evaluation. MBIR helps lowering CT chest RD to that of CXR. CT may become the preferred imaging tool in CF assessment.

B-0432 14:27

Sources of variability in the quantification of CT perfusion of the lung in patients with idiopathic pulmonary fibrosis (IPF)

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Purpose: To assess sources of variability of lung perfusion quantified by means of dynamic CT perfusion.
Methods and Materials: : Two dynamic pulmonary CT perfusion (DCTP) scans were obtained in 8 patients with IPF during breath-hold using a Toshiba Aquilion-One. Perfusion was quantified by maximum-slope technique. Mean perfusion values were compared between 2 scans on identical regions of interest in each lung at three pre-determined levels. Intraobserver and intramodality variability was assessed. < 30% variation was determined as clinically acceptable.
Results: Observed means in the 16 scans ranged from 57 to 537.3 mls/100 g/min. There was intraobserver agreement (variability < 10%; r2 = 0.98 - 0.74). Clinically acceptable intramodality variations were observed in 5 of 8 patients. Clinically unacceptable variation was seen in 3 patients (up to 98% difference in mean values). Breathing motion artefact was a major source of intramodality variation. Adjusting for breathing artefact reduced variations in observed means (reducing the maximum variation by 4% and the average variation by 22%). Changes in the characteristics of the input function (e.g. high pulmonary time-density baseline values and different curve slope) were also sources of measurement bias. Effect of lung density change due to different depth of breath-hold was minimal. Despite significant variation between the patients 2 scans, the ratio of values between the 2 lungs in both scans remained relatively constant.
Conclusion: DCTP provides a physiological mean to assess pulmonary perfusion. Post-processing analysis of the results is challenging and awareness of the pitfalls is necessary to apply the tests in clinical trials.

B-0433 14:36

Effectiveness of an automated tube potential selection tool in contrast enhanced thoracic staging CT examinations

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Purpose: To evaluate a novel automated scanogram-based voltage selection tool (AkV) combined with automated tube current adaptation for thoracic computed tomography in terms of objective image quality and potential radiation dose reduction.
Methods and Materials: Three months after AkV (CAREkV, Siemens, Forchheim, Germany) was introduced into clinical routine in our institution, patients who had received a previous thoracic CT examination with 120 kV and a follow-up exam using AkV were retrospectively included. Besides AKV, all other scanning parameters were kept constant. Contrast dose was individually determined. Patients with identical tube potentials in both examinations were excluded. Contrast-to-noise ratios (CNR) were assed in multiple slices within the thoracic aorta at identical levels within each patient. Cross-sections were measured to document patients cross sectional areas. The effective radiation dose (ED) was estimated as the product of the dose-length product (DLP) and a chest specific conversion coefficient (k=0.014 mSv/(mGy*cm)). Measurements were statistically treated as paired samples.
Results: Forty-eight patients (35 female, 51.0±14.0 years) were included. In arterial phase thoracic imaging, CNR was constant for AkV vs. 120 kV in the descending aorta (18.8±5.6 vs. 19.3±6.1; p=0.56) and pulmonary artery (21.0±6.2 vs. 21.8±6.2; p=0.33). ED was significantly lower using AkV (3.15±1.3mSv vs. 4.1±1.3mSv; p < 0.001). Cross-sections (2346±509 cm^2 vs. 2343±498 cm^2; p=0.91) and volume of contrast media (86.25±12.8 ml vs. 89.4±16.3; p=0.15) did not differ significantly.
Conclusion: Compared to standard 120 kV-protocols, AkV leads to a relevant radiation dose reduction in contrast enhanced thorcic CT examinations while CNR of both techniques remains equal.

B-0434 14:45

Artefact reduction of dual-energy lung perfusion image using a tin filter: a phantom study and evaluation on clinical images

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Purpose: To investigate the reliability of lung perfusion blood volume (PBV) images created by dual-energy CT (DECT) equipped with or without a tin filer, focusing on its accuracy adjacent to high attenuation areas.
Methods and Materials: A columnar phantom made of hollow resin clay containing 4.0 mgI/cm^3 with agarose gel containing 50 mgI/mL in the center (73 and 18 mm in diameter, respectively) was used to simulate contrast-enhanced lung parenchyma and central veins, respectively. It was scanned by DECT at 80/140 kVp with or without a tin filer and examined the area of enhancement decline adjacent to the central high-attenuation gel on the lung PBV images. In the clinical study, 40 patients (mean age, 65; range, 16 to 93 years) without apparent pulmonary embolism were included. They underwent DECT with (n = 20) or without (n = 20) the filter and the degrees of artifact - pulmonary enhancement defect and pseudo-enhancement in the trachea adjacent to the vena cava were evaluated using a four-point scale (0 = minimal to 3 = prominent).
Results: In the phantom study, the areas with less than 95% enhancement compared to the maximum values were 87.6 and 162 mm^2 with and without filter, respectively. In the clinical study, the mean degrees of artifact with vs. without filter were 0.85±0.58 vs. 2.0±0.8 (p < 0.0001) and 1.1±0.5 vs. 2.2±0.7 (p < 0.0001) for pulmonary enhancement defect and pseudo-enhancement in the trachea, respectively.
Conclusion: The quality of dual-energy lung perfusion image will be improved by using the tin filter technique.

B-0435 14:54

Minimising dose in test bolus CT pulmonary angiography (CTPA): can tube potential be routinely lowered to 80 kVp during contrast monitoring?

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Purpose: Technological advances have dramatically reduced CTPA dose. However, the monitoring phase represents increased proportion of overall dose. We aimed to determine whether monitoring in test-bolus CTPA can be routinely performed at 80 kVp to minimise dose without affecting diagnostic quality.
Methods and Materials: Retrospective analysis of two test bolus CTPA protocols was performed. Fifty consecutive patients scanned with protocol A (low monitoring kVp: 80 kVp and 45 mAs) were compared to fifty consecutive patients scanned with protocol B (standard monitoring kV: 100 kVp and 45 mAs). Diagnostic phase parameters were the same for both (100 kVp and 150 reference mAs). Scans were assessed for quality (mean attenuation, signal to noise (SNR) and contrast to noise (CNR) in the main pulmonary artery (MPA), percentage of diagnostic scans (> 200 HU in MPA) and number of repeated monitoring scans). Mean effective dose was calculated.
Results: No difference in mean MPA attenuation (415.5±35.8 HU vs 410.1±29.9 HU, *P*=0.820), SNR (11.0±0.9 vs 10.8±0.9, *P*=0.819) or CNR (9.1±0.9 vs 9.0±0.9, *P*=0.855) between protocols. Diagnostic rates (96% vs 100%, *P*=0.741) and number of repeated monitoring scans (0% vs 0%) were similar. Mean monitoring phase dose was significantly lower (0.07±0.01 mSv vs 0.15±0.02 mSV, *P* < 0.0001) for protocol A, accounting for 3.2% of the total CTPA study dose compared with 6.8% in Protocol B.
Conclusion: Monitoring should be performed at 80 kVp in test bolus CTPA to significantly lower dose, without compromising diagnostic quality. Increased image noise can be tolerated because the monitoring images are not required for diagnosis and contrast kinetics can still be reliably determined.

B-0436 15:03

SubmSv CT imaging of pulmonary arteries using an iterative model reconstruction algorithm

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Purpose: To investigate the improvement in diagnostic quality of iterative model reconstruction (IMR) algorithm for submSv computed tomography angiography of the pulmonary arteries (CTA).
Methods and Materials: Eighteen patients with CTA were included, 8 with and 10 without pulmonary artery embolism. All scans were performed at 120 kVp (average effective doses 4.34±1.99mSv). Acquisitions with reduced radiation exposure were simulated from the original CT data to 15% of the tube current, resulting in a submSv average dose of 0.65±0.30mSv. Filtered backprojection (FBP) was used to reconstruct the original data (protocol A); submSv data were reconstructed using FBP (protocol B) and IMR (protocol C). Image quality, image noise and contrast tonoise ratio (CNR) were assessed. Two blinded readers determined subjective image quality and assessed the detectability of pulmonary artery embolism.
Results: With IMR noise could be subjectively removed, while the image texture of these images differed from FBP reconstructions. Specifically, with IMR, the noise was significantly reduced by a factor up to 20 (B vs. C). CNR and image quality were improved with a median image quality score of 3 (IMR,B) vs. 1 (FBP,C),$p < 0.05$. With respect to diagnostics protocol A and C were identical, while B was worse: To detect pulmonary artery embolism in IMR and FBP low dose images, the sensitivity was 100% for IMR and 62.5% for FBP while specificity was 100% for both protocols.
Conclusion: This simulation study indicates that by using IMR, pulmonary artery embolism can be detected accurately in scans with submSv dose levels.
Author Disclosures:
T. Koehler: Employee; Philips. **B. Brendel:** Employee; Philips. **K. Brown:** Employee; Philips. **S. Zabic:** Employee; Philips.

B-0437 15:12

Pulmonary CT angiography: evaluation of high concentration contrast medium protocols for radiation dose reduction

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Purpose: A high iodine delivery rate (IDR) yields a high signal in CT angiography (CTA), potentially compensating for a reduced radiation dose. The present study evaluates the combination of a high IDR with a low tube current time product for pulmonary CTA.
Methods and Materials: One-hundred nineteen consecutive patients undergoing pulmonary CTA for suspected pulmonary embolism were included and imaged on a 128-row CT scanner at 100 kVp using highly concentrated contrast material (85 ml Iomeprol; 400 mg iodine/ml). The protocol entailed a flow rate of 5 ml/s and 90 mAs for group A, 3.5 ml/s and 135 mAs for group B, 5 ml/s and 135 mAs for group C, and 3.5 ml/s and 90 mAs for group D. SNR and CNR were determined for the pulmonary artery. Subjective image quality (IQ) was rated on a 5-point-scale (1_non-diagnostic IQ - 5_excellent).
Results: CNR did not differ significantly between group A (43.7±27.7), B (34.5±17.9) and C (38.9±13.8) as well as between group B and D (29.9±11.2). CNR in group A and C was higher than in group D ($p < 0.02$). Subjective IQ in group A (4.7±0.47) was higher than in group B (4.33±0.76) and D (4.41±0.5) ($p < 0.05$).
Conclusion: A high IDR (highly concentrated contrast material combined with a high flow) permits a mAs-reduction of approximately 33% without compromising image quality in pulmonary CTA. Therefore the concept of "high IDR - low mAs" can be recommended in patients with suspected pulmonary embolism.
Author Disclosures:
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B-0438 15:21

Bone suppressed images improve pulmonary fungal infection detection in chest radiographs

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Purpose: To assess the effect of bone suppression images (BSI) on observer performance in detecting pulmonary fungal infections (PFI) on chest radiographs.
Methods and Materials: 105 frontal (bedside or PA) chest radiographs (CXR) of suspects for PFI were collected from four institutions. Presence or absence of disease was determined by an expert radiologist and a clinical researcher in consensus, using CT as reference standard. Radiographs could contain single or multiple sites of infection, and were classified into four categories of subtlety. BSI were generated by ClearRead BSI 3.2 (Riverain Technologies, Ohio). Five radiologists and two residents participated in an observer study. Evaluation was done on a per lung basis, resulting in 78 diseased lungs and 132 normal lungs. Observers scored the lungs on a continuous scale (0-100), and marked the most suspicious lesion, if present. Area under the ROC curve (AUC) served as performance measure. P-values were calculated using the Dorfman-Berbaum-Metz method. Sensitivity and specificity were calculated considering only the lungs with a suspiciousness score over 50 to be positive.
Results: AUC without BSI was 0.815, and increased to 0.853 with BSI ($p=0.01$). Six of the seven observers increased their performance, four of them significantly. Sensitivity increased from 49% to 66%. Specificity dropped from 95% to 90%. Significant improvement of performance was seen in the group of very subtle cases ($p < 0.001$).
Conclusion: BSI significantly improved detection performance of PFI in chest radiographs, especially for very subtle abnormalities. BSI improved the sensitivity of the CXR examination, outweighing the smaller loss in specificity.
Author Disclosures:
S. Schalekamp: Research/Grant Support; Riverain Technologies. **N. Karssemeijer:** Research/Grant Support; Riverain Technologies. **C.M. Schaefer-Prokop:** Advisory Board; Riverain Technologies.

14:00 - 15:30 **Board Room B**

Musculoskeletal

SS 610b

Inflammatory diseases

Moderators:
F. Becce; Lausanne/CH
F. Kainberger; Vienna/AT

B-0439 14:00

Dynamic contrast-enhanced low-field (0.25T) MRI wrist in rheumatoid arthritis compared with high-field (3.0 T) MRI

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Purpose: The volume of enhancing synovial tissue and degree of perfusion by dynamic contrast-enhanced MRI is helpful in determining response to treatment. This has not been assessed on low-field MRI. The aim of this study is to compare assessment of wrist synovitis severity, enhancing synovial volume and synovial perfusion indices of low-field (0.25T) MRI in patients with rheumatoid arthritis with high-field (3.0 T) MRI.
Methods and Materials: Prospective study of 21 patients (F:M = 16:5, mean age 50.0 ± 9.8 years) with active rheumatoid arthritis. Dynamic contrast-enhanced MRI examination of the most severely affected wrist was performed on both 0.25T (G-SCAN, Esaote, Italy) and 3.0 T (Achieva TX-series, Philips Medical Systems, Best, Netherlands) whole-body imaging systems. Three MRI parameters [synovitis severity (RAMRIS grade), active synovitis volume (ml^3), and synovial perfusion indices (maximum enhancement (%,) enhancement slope (%/sec))] were compared.
Results: Comparing 0.25T and 3.0 T MRI, there was excellent agreement for semi-quantitative assessment (r:0.97, $p < 0.00001$) and quantitative assessment (r:0.94, $p < 0.00001$) of enhancing synovial volume. Good agreement of Emax (r:0.6, p= 0.002) and fair agreement (r:0.5, p=0.02) for Eslope were identified.
Conclusion: 0.25T MRI yields excellent synovial volume assessment and fair to good perfusion parameters to 3 T MRI and can be used to assess therapeutic response in rheumatoid arthritis patients.

B-0440 14:09

Unenhanced and dynamic contrast enhanced (DCE) MRI in assessment of scaphoid fracture non-union revisited: role in pre-operative planning

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Purpose: Accurate pre-operative assessment of proximal pole vascularity aids in appropriate surgical planning for treatment of non union of scaphoid fractures. Our study aims to evaluate the usefulness of DCE-MRI in pre-operative assessment and surgical planning in treatment of scaphoid non-union.
Methods and Materials: A retrospective study between Jan 08-May 13 identified 20 patients who underwent pre-operative dynamic Gadolinium-enhanced wrist MRI on 3 T. Time interval between initial injury and MRI study was recorded. Using Siemens Mean curve software, a contrast enhancement curve was generated on dynamic contrast enhanced T1 images with regions of interest defined in the proximal, distal scaphoid poles and radial styloid. The steepest upslope of gadolinium enhancement curve was assessed to determine the degree of vascularity. Results were graded as normal, impaired vascularity and avascular necrosis (AVN). Unenhanced T1 signal of proximal pole and subjective assessment of its enhancement pattern were also analysed. Intra-operative findings were used as gold standard.
Results: 14/20 (70%) scans corresponded to intra-operative findings of the proximal pole vascularity. 5/20 (25%) had discordant results of which 4/5 cases had time interval of > 7 months between injury and scans. 1/20 had no intra-operative confirmation. Sensitivity, specificity and accuracy of the DCE-MRI were 64%, 100% and 74% respectively. In 7/20 confirmed AVN cases, fat signal was demonstrable on unenhanced T1 images making it a non-specific finding
Conclusion: Dynamic contrast enhanced MRI is a reliable tool for pre-operative assessment of proximal pole vascularity and surgical planning. However MRI results may be confounded if the fracture is old (> 7 months).

B-0441 14:18

Hybrid 18 F-FDG PET-MRI of the hand in rheumathoid arthritis

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Purpose: 18 F-FDG-PET is highly sensitive to inflammatory activity in rheumatoid arthritis (RA). However, MRI is most sensitive of joint damage in RA due to its high soft tissue contrast. The purpose of the present study was to test the feasibility of true hybrid PET-MRI of the hand in RA and to compare the assessment of synovitis in PET and MRI.
Methods and Materials: True hybrid 18 F-FDG PET-MRI was acquired in four patients (all female; average age: 48 years, range 24-58). Two presented with early therapy-naive RA, two presented prior to therapy escalation. PET-MRI were acquired on a APD-based magnetoinsensitive BrainPET Detector (Siemens, Erlangen, Germany) in a 3 T MRI scanner (Magnetom Trio, Siemens). The MRI data were evaluated according to the RAMRIS synovitis criteria. The PET of the same joints was categorised semiquatitatively. Additional findings, not included in the RAMRIS were recorded.
Results: All patients were positive for synovitis in MRI and PET. On a joint level, 21/26 (81%) of joints were MRI-positive, and 18/26 (69%) were positive on PET. In three joints that demonstrated synovitis on MRI, glucosis utilisation was normal (14%). Synovitis severity as measured in PET and MRI correlated significantly ($r = 0.672$; $P < 0.001$). In 6/10 additional abnormal findings, there was concordance between MRI and PET.
Conclusion: The results point towards the validity of 18 F-FDG PET-MRI of the hand in RA. 18 F-FDG PET-MRI may possibly be a tool for further research and therapy monitoring of both, inflammatory activity as well as joint destruction in RA.
Author Disclosures:
G. Antoch: Speaker; Siemens Medical Solutions, Bayer Healthcare, BTG.

B-0442 14:27

Biochemical MRI with glycosaminoglycan chemical exchange saturation transfer imaging of finger joint cartilage in rheumatoid arthritis

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Purpose: Rheumathoid arthritis (RA) frequently involves finger joint. gagCEST has been demonstrated to visualise biochemical alterations of cartilage in knee joints following cartilage repair surgery as well as in intervertebral discs. The purpose of our study was to test the feasibility of gagCEST in finger cartilage in healthy volunteers and patients with RA.
Methods and Materials: Six volunteers (mean age 33; range: 21-45 years) and four patients (age 58; range: 52-64 years) were examined at a 3 T MR scanner. For gagCEST imaging, CEST effects were prepared by a train of Gaussian RF pulses followed by signal readout with a 3D RF spoiled GRE sequence. The CEST curves were calculated for each pixel and were shifted for the water resonance to appear at 0 ppm of the Z-Spectrum. The MTR asymmetry curves were determined. The CEST effect of the cartilage was measured with the glycosaminoglycan saturation transfer [ST = CEST (+1.3 ppm) - CEST (-1.3 ppm)/CEST (+1.3 ppm)]. Joint space width (JSW) was measured.
Results: Cartilage ST values were significantly lower in patients compared to healthy volunteers (13.58 ± 6.11 vs. 27.38 ± 4.52; $p=0.011$). CEST curves showed a decrease between 1.2 and 2.2 ppm, corresponding to the resonance frequency of hydroxyl protons of glycosaminoglycans. There was no significant difference in JSW.
Conclusion: CEST imaging revealed alterations in finger cartilage of RA patients compared to healthy controls in the absence of cartilage thinning. The decreased CEST effect in the spectral range of glycosaminoglycan resonances points towards depletion of glycosaminoglycans in RA.
Author Disclosures:
G. Antoch: Speaker; Siemens Medical Solutions, Bayer Healthcare, BTG.

B-0443 14:36

Characterisation of metacarpal and radial bone in rheumatoid arthritis using high-resolution peripheral quantitative CT

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Purpose: 1) To develop a standardised method of quantifying BMD and microarchitecture in the hand and wrist bones of patients with rheumatoid arthritis (RA) using HR-pQCT; 2) to compare quantified bone parameters of controls to those of RA and post-menopausal osteopenic (PM-OP) subjects, and 3) to correlate quantified bone parameters at the distal radius and metacarpal heads of RA subjects.
Methods and Materials: HR-pQCT imaging of the dominant hand and wrist was performed in 12 female RA patients and 20 healthy female controls. BMD and trabecular parameters for the 2-12% head region of the metacarpals were calculated and compared between RA and controls. Bone parameters were also calculated for the distal radius in RA patients and compared to data from controls and 44 PM-OP women. Clinical evaluations of RA patients were examined for correlation to bone parameters.
Results: Compared to controls, RA patients had significantly decreased BMD, trabecular volume and number, and increased trabecular heterogeneity.There were no significant differences in the bone parameters between RA patients and PM-OP women, except trabecular number. Trabecular BMD in the third metacarpal and in the distal radius were significantly correlated ($\rho=0.918$, $p < 0.0001$) in RA patients.
Conclusion: This study established a standardised method for quantifying bone density and trabecular properties in the hand and wrist bones of RA patients using HR-pQCT. Deterioration of bone structure in RA patients was found comparable to that in osteopenic women, and trabecular bone loss near affected joints was found to be correlated with bone loss away from joints.

B-0444 14:45

Ultrasound findings in hand joints involvement in patients with psoriatic arthritis and its correlation with clinical DAS 28 score

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Purpose: To evaluate the ultrasound findings in hand joints in patients with psoriatic arthritis and correlate grayscale and power Doppler ultrasonography findings with Disease Activity Score 28.
Methods and Materials: This prospective study was performed in 30 patients. Ultrasound evaluation of 28 joints of both hands was undertaken and findings were recorded including synovial hypertrophy, power Doppler abnormality, soft tissue thickening, tendonitis, joint effusion, periosteal reaction and erosions. Composite ultrasound scores and Disease Activity Score 28 were calculated and compared.
Results: Ultrasound detected more abnormalities in the hand joints than did clinical examination. The frequency of ultrasound abnormalities:Synovial hypertrophy in 100%, power Doppler abnormality suggesting hypervascularity in 36.7%,soft tissue thickening in 66.7%,periosteal reaction in 33.3%,erosions in 30% (mostly in DIP and PIP joints) and flexor tendonitis in 6.7% of patients. Significant correlation was found between Disease activity score 28 and gray-scale joint score (GSJS) (Spearman's ρ: 0.499, P: 0.005),gray-scale joint count (GSJC)(ρ: 0.398, P: 0.029) and power Doppler joint score (PDJS) (ρ:0.367, P:0.046). There was a statistically significant difference between remission and low disease activity group, and moderate disease activity group in terms of GSJC, GSJS, PDJC and PDJS ($P < 0.05$). These ultrasound measures were higher in moderate disease activity zone patients.

Conclusion: Ultrasound is a useful modality for the objective assessment of psoriatic arthritis, which can detect joint inflammation to a larger extent than clinically expected. Ultrasound including power Doppler can be used as a modality for assessment of severity of psoriatic arthritis as it correlates with the clinical scoring.

B-0445 14:54

Role of MRI in evaluation of asymmetric undifferentiated inflammatory hand arthritis: can it help change the diagnosis?

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Purpose: The ACR/EULAR 2010 criteria is a clinical tool that aids the clinician in identifying patients of undifferentiated arthritis who require early aggressive therapy. MRI can increase its sensitivity by identifying patients with disease more progressed than thought of clinically thus altering the treatment.
Methods and Materials: MRI was performed for 25 patients with ACR/EULAR score of ≤6/10. Bilateral wrists, metacarpophalangeal and proximal interphalageal joints were evaluated for evidence of bone erosions, bone oedema, synovitis, tenosynovitis and effusions. Presence of synovitis and erosions or oedema was categorised as rheumatoid arthritis (RA) while absence of synovitis but presence of other findings was categorised as probable RA.
Results: The female to male ratio was 3:1 and average age was 43 years. Based on the MRI findings, a diagnosis of RA was given in 12 cases (48%) and probable RA in 7 cases (28%) giving a total of 19 cases (76%). 5 patients were still labeled as undifferentiated arthritis (20%) and 1 as post viral sequelae. Bone erosions were the commonest finding in these 19 patients, seen in 18 (94%)cases, followed by effusions 78%, synovitis (63%), tenosynovitis (52%) and bone oedema (47%).
Conclusion: Studies have shown that a significant number of patients presenting with undifferentiated arthritis will progress to RA and early therapeutic intervention delays or halts the disease. We successfully identified patients with more advanced disease than clinically thought of. Thus, the addition of MR imaging-based joint area involvement (clinically normal) may enhance the performance of the ACR/EULAR 2010 RA criteria.

B-0446 15:03

Assessment of radiographic progression in rheumatoid arthritis patients using Sharp/van der Heijde scoring method: comparison with plain radiography and tomosynthesis

M. Fujii, T. Aoki, S. Kinoshita, H. Oki, Y. Hayashida, K. Saito, Y. Tanaka, Y. Korogi; *Kitakyushu/JP*

Purpose: Sharp/van der Heijde scoring method is commonly used for the evaluation of radiographic progression in adult rheumatoid arthritis (RA) patients. The purpose of this study is to compare tomosynthesis with plain radiography of the wrist and hand for the applicability of radiographic progression assessment using Sharp/van der Heijde scoring method.
Methods and Materials: Twenty consecutive patients with established diagnosis of RA were included in this study. Plain radiography and tomosynthesis of the bilateral hand and wrist were undergone within a week at both baseline and follow-up. The mean total dose of radiography and tomosynthesis was 0.13 mGy and 0.25 mGy, respectively. Sharp/van der Heijde score on images from the 2 modalities was independently reviewed by 2 radiologists (23 and 6 years of experience in interpreting musculoskeletal radiography). Interobserver agreement for the Sharp/van der Heijde scores was analysed by computing the intraclass correlation coefficient (ICC). The reading time per case for each modality was also recorded.
Results: Significantly higher Sharp/van der Heijde scores were revealed with tomosynthesis than with plain radiography ($P < .01$). Interobserver agreement on baseline Sharp/van der Heijde scores were excellent for both plain radiography and tomosynthesis (ICC=0.95, 0.98 respectively). Agreement on change assessment was excellent for tomosynthesis (ICC=0.93) but moderate for plain radiography (ICC=0.71). The reading time with tomosynthesis was not significantly different from plain radiography.
Conclusion: Tomosynthesis is more reliable for Sharp/van der Heijde scoring method in RA patients than radiography, and may be suitable for the reference method.

B-0447 15:12

Ultrasonographic diagnosis in rheumatoid arthritis: should only symptomatic joints be scanned?

Y. Volokhina, S. Beck, A. Chien; *Loma Linda, CA/US (yvolokhina@llu.edu)*

Purpose: To investigate the validity of reduced joint counts for ultrasonographic (US) assessment of joint inflammatory activity by scanning only symptomatic joints in patients with known or suspected rheumatoid arthritis (RA).
Methods and Materials: 129 patients seen in rheumatology clinic received US scans of bilateral hands. Clinical symptoms (joint pain, swelling, warmth) and US findings (synovial hypertrophy, hyperaemia, erosions) were recorded in the scanned joints of bilateral wrists, first through fifth metacarpophalangeal and all interphalangeal joints. Assuming two different levels of disease activity of US findings, hyperaemia> synovial hypertrophy >erosions (H>SH>E) vs. hyperaemia>erosions>synovial hypertrophy (H>E>SH), each patient was analysed for correlation of US and clinical findings.
Results: 36 patients had known diagnosis of RA, and 83 patients had questionable diagnosis of RA. Out of 36 patients with known RA, scanning only symptomatic joints while assuming the H>SH>E level of disease activity, 9 patients with positive US findings would have been underreported (75% sensitivity), while 11 patients with positive US findings would have been underreported (69% sensitivity) if the accepted level of disease activity were H>E>SH. Out of 83 patients with questionable diagnosis of RA, scanning only symptomatic joints while assuming the H>SH>E level of disease activity, 28 patients with positive US findings would have been underreported (66% sensitivity), while 29 patients with positive US findings would have been underreported (65% sensitivity) if the accepted level of disease activity were H>E>SH.
Conclusion: Scanning only symptomatic joints in patients with both known and suspected diagnosis of RA would underreport the disease activity.

B-0448 15:21

Computer-aided and manual quantifications of MRI synovitis, bone marrow oedema, erosion and cartilage loss in rheumatoid arthritis

H. Yang, J. Rivoire, M. Hoppe, T. Link, X. Li; *San Francisco, CA/US (frankyang119@126.com)*

Purpose: To investigate the reliability and validity of multiple computer-aided and manual quantifications and semi-quantifications for MRI synovitis, bone marrow oedema, erosion and cartilage loss of wrist in rheumatoid arthritis (RA).
Methods and Materials: Wrist MRI was performed at 3 T in 16 RA patients and 3 controls. Synovitis volume and perfusion, bone marrow oedema (BME) volume, signal intensity and perfusion, and erosion dimension were measured by in-house developed software, and correlated with OMERAC-RAMRIS. A semi-quantitative MRI cartilage loss score system was developed. Intra-class correlation coefficients (ICCs) were used to test reproducibility of these quantifications and semi-quantifications. Spearman correlation coefficients were calculated between lesion quantifications and RAMRIS, and between MRI cartilage score and radiographic Sharp score.
Results: The intra- and inter-observer ICCs were excellent for synovitis, BME and erosion quantifications and cartilage loss grading (all > 0.89). The synovitis volume, BME volume and signal intensity, and erosion dimension were significantly correlated with corresponding RAMRIS ($r = 0.727$ to 0.900, $p < 0.05$). Synovitis perfusion parameter maximum enhancement (E) was significantly correlated with synovitis RAMRIS ($r = 0.798$), but steepest slope (S) was not. BME perfusion E and S were not correlated with RAMRIS. Cartilage loss grading was significantly correlated with the Sharp joint space narrowing score ($r = 0.635$, $p = 0.008$).
Conclusion: Multiple computer-aided and manual and semi-quantitative methods can be used to evaluate MRI pathologies in RA with excellent reproducibility. Quantitative evaluation can be more sensitive for detecting disease activity or subtle changes during follow-up than conventional scoring system.

B-0449 15:30

Biochemical cartilage MRI and synovitis severity in rheumatoid arthrits: correlation of cartilage damage and inflammatory activity

F. Miese, C. Schleich, C. Buchbender, C. Nowak, P. Kröpil, B. Ostendorf, R. Lanzman, H.-J. Wittsack, G. Antoch; *Düsseldorf/DE (dr.miese@gmx.de)*

Purpose: To test for a correlation between cartilage composition and inflammatory activity on an individual joint level in early, therapy-naïve rheumatoid arthritis (RA).
Methods and Materials: Metacaropophalangeal joints in 27 patients with RA were examined (22 females, five males, mean age 54 years). Delayed Gd-enhanced MRI of the cartilage (dGEMRIC) of MCP joints was acquired on a 3 T scanner. dGEMRIC index was determined as measure of cartilage glycosaminoglycan content. Inflammatory activity was assessed using the synovitis-subscore according to the RAMRIS-criteria on coronal T1-weighted images acquired prior to and following Gd-administration and on post-contrast axial T1-weighted images with fat suppression.
Results: Synovitis severity was 0 in three cases, grade 1 in six cases, grade 2 in eight cases and grade 3 in ten cases. Average dGEMRIC index was 408 ms ± 145 ms. There was a significant correlation between dGEMRIC index and synovitis severity (Spearman rho= -0.49; $p = 0.009$).
Conclusion: Decreased glycosaminoglycan content was significantly associated with inflammatory activity in individual metacarpophalangeal joints in early, therapy-naïve RA. The correlation was only moderately close suggesting concurrent cartilage damaging factors.
Author Disclosures:
G. Antoch: Speaker; Siemens Medical Solutions, Bayer Healthcare, BTG.

14:00 - 15:30 **Room E1**

Musculoskeletal

SS 610a

Spine

Moderators:
E.J. Ulbrich; Zurich/CH
F.M.H.M. Vanhoenacker; Antwerp/BE

B-0450 14:00

Lumbar spine MRI findings predicting instability: a comparative study using flexion-extension radiography

J.P.M. Vrouwe[1], G.K. Thawait[1], M. Reijnierse[2], D.B. Cohen[1], L.H. Riley[1], K.M. Kebaish[1], U. Thakur[1], R. Rao[1], J.A. Carrino[1]; [1]*Baltimore, MD/US*, [2]*Leiden/NL (j.p.m.vrouwe.2@umail.leidenuniv.nl)*

Purpose: Lumbar spine MRI is performed in supine position and interpretation often occurs without radiographic comparison. The purpose of this study was to identify lumbar spine MRI predictors for radiographic instability.
Methods and Materials: Institutional review board approval was obtained for this retrospective study. 970 lumbar spine levels of 194 patients [mean age 58.8; range 19-87; 109 (56.1%) female] were reviewed in flexion-extension radiographs as well as T1,T2 and STIR weighted MRI. Excluded were patients with a history of spinal problems. MRIs were assessed for the qualitative presence of high intensity zone (HIZ), Modic change and facet joint bone marrow oedema (BME); disc degeneration, facet joint osteoarthritis (FJOA), disc contour appearance, muscular atrophy (MA) and central stenosis (CS) were rated semi-quantitatively. Quantitative data were collected for facet joint effusion/widening (FJE), facet angles (FA) and interfacet distance (IFD). Data were analysed by odds ratio calculation and using 2-sided independent t-test.
Results: Of the 970 levels, 177 (18.2%) levels had radiographic evidence of instability; these cases were female in 59.3%(105/177), controls in 55.5%(440/793). MRI showed 120 levels of listhesis. Odds ratios were calculated for: HIZ-1.32 (0.91-1.93) p=0.143; Modic change-2.39 (1.71-3.32) $p < .01$; and BME-2.61 (1.62-4.20), $p < 0.01$. Comparison of the semi-quantitative findings showed higher degrees of disc degeneration ($p < 0.01$), FJOA (p=0.001), abnormality in disc contours (p=0.001), MA ($p < 0.001$), and CS ($p < .001$) in cases than in controls. Processing of numeric ratings showed a mean FJE of 1.76 mm in cases and 1.29 mm in controls (p=0.001); mean FA was 55° and 54°, respectively (p=0.68); mean IFD was 3.56 cm and 3.42 cm, respectively (p=0.14).
Conclusion: Several degenerative changes on MRI are more frequently present with radiographic instability.

B-0451 14:09

A clinical epidemiological imaging study of spinal segment variants in a non-symptomatic population

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Purpose: Spinal variances may lead to confusion and inaccurate numbering of the vertebral segments. The purpose of this abstract is to determine the prevalence of spinal segmental variants in an asymptomatic population.
Methods and Materials: Institutional review board approval was obtained for this retrospective study. Review of whole body isotropic Computed tomography (CT) of 450 patients (males 171; mean age 31, age range17-45) without back pain was performed. Vertebral numbering was performed and the presence of cervical ribs, thoracolumbar transitional vertebra (TLTV); and lumbosacral transitional vertebra (LSTV) was documented. Cervical ribs and variances were noted. TLTVs were defined as presence of hypoplastic ribs (HR) or non-fused transverse apophyses (NFA) at the level of lowest rib-bearing segment. LSTVs were characterised as per Castellvi.
Results: 450 cases were reviewed and the number of presacral segments was accounted for as: 22 in 0.2%(1/450), 23 in 1.8%(8/450), 24 in 93.3%(420/450) and 25 in 4.7%(21/450). Presence of cervical ribs was seen in 4.2%(19/450) and elongated C7 transverse process in 2.7%(12/450) of the study population. TLTV was found in 23.3%(105/450) with HR in 9.6%(43/450) and NFA in 13.8%(62/450). LSTV was noted in 26.4%(119/450) of the population and they were classified based on Castellvi's classification as: Type Ia in 3.8%(17/450), Type Ib in 2.2%(10/450), Type IIa in 6.9%(31/450), Type IIb in 6.4%(29/450), Type IIIa in 1.1%(5/450), Type IIIb in 3.8%(17/450) and Type IV in 2.2%(10/450).
Conclusion: This study provides a clinical epidemiological approximation for prevalence of spinal segmental variability and highlights the large variability of segmental anatomy relevant to spine imagers and clinicians.

B-0453 14:27

The effect of active referral guideline implementation on the number and justification of spine radiographs in municipal health centres in one city

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Purpose: To determine the effects of active implementation of referral guidelines on the number and justification of spine radiographs requested by practitioners in municipal health centres in one city.
Methods and Materials: Specified guidelines for spine radiographs were distributed, first time with an educational cover letter, by e-mail to referring practitioners and the staff of the radiology department altogether three times during the study period. Educational lectures were also provided. The number of spine radiographs (patients aged ≥16 years) during similar 6-month periods in the year preceding the interventions and the following 2 years was analysed. Furthermore, justification of 450 different spine radiographs performed during these years was assessed by using requests and corresponding patient files. Difference between the total numbers of examinations was calculated using χ^2goodness of fit test and changes in proportions of justified cases using independent samples χ^2test.
Results: After interventions, the total number of spine radiographs decreased by 48% (9.53/1000 citizens vs. 4.98/1000, $p < 0.001$) and that of the cervical spine by 46%(2.29/1000 vs. 1.23/1000, $p < 0.001$), thoracic spine by 53% (1.22/1000 vs. 0.58/1000,$p < 0.001$) and lumbar spine by 47% (6.02/1000 vs. 3.18/1000, $p < 0.001$). The results persisted after 1-year follow-up. Before interventions, 24% (12/50) of the cervical, 46% (23/50) of the thoracic and 32% (16/50) of the lumbar spine radiographs were justified. After interventions only justification of the lumbar spine radiographs improved significantly, 64% being justified (p=0.005).
Conclusion: The number of spine radiographs decreased significantly. The level of justification was low and only justification of the lumbar spine radiographs improved significantly.

B-0454 14:36

Signal intensity of the cervical spine

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Purpose: Disc degeneration in the cervical spine has not been described so far. No classification system for the cervical spine exists. Therefore, we applied the Pfirrmann classification to the cervical spine.
Methods and Materials: Patients (n = 260) from the SPondyloArthritis Caught Early (SPACE) cohort were included with back pain ≥ 3 months, ≤ 2 years, onset < 45 years. Cervical T1 and STIR MR sagittal images were scored on the Pfirrmann classification scale by two readers, a third acted as adjudicator. The Pfirrmann classification describes degenerative changes of intervertebral discs in the lumbar spine on a 5-points scale: class 1 normal, class 5 collapsed disc space.
Results: 1300 intervertebral discs were scored (C2-C3 though C6-C7). 499 (38%) discs had a Pfirrmann score of 1, 664 (51%) discs were scored as class 2, 128 (10%) discs were scored as class 3, 8 (1%) as class 4 and 1 (0%) as class 5. Frequencies of class 2 and up were highest on levels C2-C3 and C3-C4, 168 (65%) and 178 (68%). In 126 (48%) patients, the first 4 intervertebral discs were scored as class 2 or higher.
Conclusion: Over half of all cervical discs were inhomogeneous without loss of height (Pfirrmann 2), 11% of discs were grey to black and had loss of height to some degree (Pfirrmann 3 or higher). The upper levels of the cervical spine were most frequently affected. The Pfirrmann class of the cervical spine appears higher than the lumbar spine and might be a normal variant.

B-0455 14:45

Determinants of evolution of endplate and disc degeneration in the lumbar spine: a multifactorial perspective

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Purpose: Radiographic progression of disc and endplate degeneration of the lumbar spine is thought to be multifactorial. The aim of this study was to find the strength of influence and interaction of the factors and their interaction in order to understand which are the most important determinants in evolution or progression of lumbar spinal degeneration.
Methods and Materials: Patients (n=90) who underwent two lumbar MRI exams with an interval of at least four years and without any spinal surgery where retrospectively included. Disc degeneration was scored according to the Pfirrmann classification and endplate changes according to Modic in 450 levels on both MRIs. Potential variables for degeneration such as age, gender, BMI, scoliosis and sagittal parameters were compared between patients with and without evolution or progression of degenerative changes in their lumbar spine.

A multivariate analysis aimed to separate the most important variables for progression of disc and endplate degeneration, respectively.
Results: While neither age, gender, BMI, sacral slope or presence of scoliosis could be identified as progression factor for disc degeneration, a higher lordosis was observed in subjects with no progression (49.2±11.0 vs 43.2±11.7,p=0.017). Progression or evolution of endplate degeneration was only associated with higher degree of scoliosis (9.5±10.4 versus 5.9±9.0; p=0.0078) and not to any of the other variables.
Conclusion: While a scoliotic deformity of the lumbar spine is associated with evolution or progression of endplate degeneration, a higher lumbar lordosis seems protective for radiographic progression of disc degeneration.

B-0456 14:54

Comparison of lumbar disk height measurements between EOS system and digital radiography

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Purpose: Biplane slot scanning systems are used by clinicians in daily practice, based on two low-dose simultaneous digital anteroposterior and lateral radiographs, avoiding the magnification presented in digital radiography (DR) images. The aim of this study was to compare lumbar disk height (LDH) between a biplane slot scanning system (i.e. EOS system) and a DR system, showing that biplane slot scanning systems provide more accurate measurements.
Methods and Materials: (a) In-vivo: 50 patients [41 women, 9 men, age: mean (SD): 49.4 (10.7)] presenting chronic low back pain were included. Lateral radiographs of the spine were obtained with the EOS system and a DR system. Two senior clinicians measured the LDH between L3-L4, L4-L5 and L5-S1. Mean (SD) of the measurements, reproducibility (ICC coefficient) between both readers, as well as image quality (from 0 to 10) were calculated. (b) In-vitro: we used a phantom apparatus to perform five vertical displacements of 2 mm on two dry vertebrae. LDH was measured for each displacement with EOS and DR.
Results: (a) In-vivo: Image quality was equivalent for both systems, as well as reproducibility. LDH measured (in mm) by DR was systematically higher as compared to EOS system [Reader 1- EOS:7.3 (1.9), DR: 8.9 (2.6), Reader 2 - EOS:7.3 (1.5), DR: 10.1 (1.9)]. (b) In-vitro: Mean (SD) differences between true and measured LDH for EOS [0.4 (1.1) mm], and DR [2.1 (1.4) mm] were statistically significant (Student's t test $p < 0.05$).
Conclusion: Biplane slot scanning systems provide reliable measurements of the LDH while reducing the radiation dose.

B-0458 15:03

Association of low-back pain with modic type endplate changes and disc degeneration using a detailed MRI-classification

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Purpose: Modic type 1 signal abnormality in bone marrow (M1) may have impact on treatment decisions for low-back pain (LBP) patients. M1 is associated with rapidly progressing bony endplate lesions (EPL) and disc degeneration (DD). The association of LBP with M1s, EPLs and DD was studied with a more detailed grading method than conventional Pfirrman and Modic classification.
Methods and Materials: 49 patients with chronic nonspecific LBP and large M1 had a follow-up MRI (1.0 T) after one year. Severity of LBP (VAS) on numerical scale 0-10 and of disability (ODI) on scale 0-100 was questioned and size of M1, severity of adjacent EPLs and of DD was visually classified in consensus at baseline and follow-up. Change in VAS and ODI was non-parametrically correlated with change in M1 size and grade of EPLs and DD separately (Pearson correlation, 2-tailed).
Results: Increase of pain (VAS) correlated with increase of M1 ($p < 0.01$) and of EPLs (p=0.02) and with increase of signal intensity of nucleus pulposus (DSI) in discs with decreased height (p=0.01). ODI correlated with increase of DSI (p=0.03) and with increase of M1 (p=0.07).
Conclusion: In addition to signal abnormalities in subchondral bone marrow, defects and irregularities in endplate region and increase of signal intensity in nucleus pulposus may be at least as important as conventionally classified Modic changes and degenerative disc changes in explaining nonspecific LBP. Detailed classifying separate changes in subchondral bone marrow, disc and endplate may promote MRI-diagnostics of the pathologic, progressive degenerative disc disease.

B-0459 15:12

Image quality optimisation of spinal exams with metal artifacts using iterative reconstruction in combination with monoenergetic extrapolation

H. Haubenreisser[1], M. Hahn[1], J.W. Nance[2], P. Apfaltrer[1], M. Sedlmair[3], B. Schmidt[3], S.O. Schönberg[1], T. Henzler[1]; [1]*Mannheim/DE*, [2]*Baltimore, MD/US*, [3]*Forchheim/DE (Holger.Haubenreisser@medma.uni-heidelberg.de)*

Purpose: To evaluate the effectiveness of spectral CT in combination with iterative reconstruction (IR) in the raw data space in reducing metal artifacts caused by pedicle-screws in patients with dorsal spinal fusion.
Methods and Materials: 10 consecutive patients with dorsal spinal fusion with a total of 57 pedicle-screws referred for dual-energy CT (DECT) of the spinal column were prospectively included in the study. Data was acquired at 80 and 140 kVp. Each DECT dataset was reconstructed with traditional filtered back projection (FBP) as well as IR, after which monoenergetic image sets ranging from 60keV to 180keV were generated at 10keV intervals. Both objective (quantitative artifact and image noise measurements) and subjective evaluation (diagnostic quality, depiction of pedicle-screws and surrounding structures) were performed.
Results: Image quality of monochromatic images in the range from 80 keV to 120keV was rated superior to both the conventional polychromatic images as well as the monochromatic sets at lower energies. In addition, even though IR had no significant impact on the presence of artifacts (p=0.841-0.998), both objective ($p < 0.001$) and subjective ($p < 0.001$) image quality parameters of sets reconstructed with IR were consistently better than the FBP sets. Interobserver agreement was good to excellent (Cohen's K=0.74).
Conclusion: Compared to conventional polychromatic images, monochromatic images acquired from DECT provided superior image quality with reduced metal artifacts in patients with spinal fusion. Optimal energy range was at around 110 keV. IR was found to further improve both subjective and objective image quality, especially of the surrounding tissue.
Author Disclosures:
M. Sedlmair: Employee; Siemens Medical Solutions. **B. Schmidt:** Employee; Siemens Medical Solutions.

14:00 - 15:30 **Room F2**

Breast

SS 602

Beyond B-mode ultrasound

Moderators:
G. Forrai; Budapest/HU
A. Linda; Udine/IT

B-0461 14:00

Evaluation of breast lesions with a spiculation and retraction severity index (SRSI) on coronal reconstructions of automated breast ultrasound improves differentiation between benign and malignant lesions

J.C.M. van Zelst[1], B. Platel[1], M. de Jong[2], T. Tan[1], M. Rutten[2], R.M. Mann[1], N. Karssemeijer[1]; [1]*Nijmegen/NL*, [2]*'s-Hertogenbosch/NL (j.vanzelst@rad.umcn.nl)*

Purpose: To investigate the value of a spiculation and retraction severity index (SRSI) in coronal reconstructions of ABUS to improve the differentiation between benign and malignant breast lesions.
Methods and Materials: 96 ABUS scans from 96 patients were obtained. All scans contained a biopsy-proven lesion (36 malignant, 60 benign). Each scan was presented to 5 breast radiologists (ABUS experience 0-3 years). First, only the transversal acquisition was shown. Readers were asked to classify the most suspicious lesion in the scan using the BI-RADS lexicon. A likelihood-of-malignancy (LOM) score (0-10.0) was requested. Thereafter, the coronal reconstruction was shown. Readers were asked to rate spiculation and retraction in the coronal plane on the SRSI, a 5-point semi-continuous index. Subsequently, LOM-scores could be adjusted. The differentiating capacity of SRSI between benign and malignant lesions was assessed using ROC-analysis. Reader agreement for SRSI was computed with the intraclass correlation coefficient (ICC). AUCs based on LOM-scores prior to and after evaluation of the coronal scans were calculated using multi-reader-multi-case ROC-analysis.
Results: The SRSI is highly discriminative between benign and malignant lesions with AUCs ranging from 0.796-0.883. The ICC shows substantial agreement between readers in assessing SRSI (0.605, $p < 0.001$). All readers improved their performance after evaluation of the SRSI with an overall increase in AUC from 0.82 to 0.87 (p=0.01). Moreover, readers downgraded 3%-18% benign cases to BI-RADS 2 avoiding unnecessary biopsies.

Conclusion: Evaluating spiculation and retraction patterns on coronal reconstructions of ABUS using SRSI, improves radiologists' performance in the differentiation between malignant and benign breast lesions significantly.

B-0462 14:09

The impact of real-time virtual sonography in the surgical management of breast cancer: a single-institution review

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Purpose: Real-time virtual sonography (RVS) synchronises ultrasonographic images and MR images of the same section in real time. The aim of this study was to evaluate the impact of RVS in the surgical management of breast cancer.
Methods and Materials: A total of 108 breast cancer patients were identified as candidates for breast-conserving surgery (BCS) based on conventional assessments and underwent a preoperative breast MRI. When the additional lesion was detected by MRI, it was preoperatively assessed by second-look ultrasonography (US) and, if needed, US-guided needle biopsy. If the additional MRI lesion was undetectable by conventional US, we performed a second-look US assessment with the use of RVS.
Results: In 46 out of the 108 affected breasts, 49 additional ipsilateral MRI lesions were detected. The detection rate of the additional MRI lesions by conventional second-look US was 45%, while the rate went up to 92% when using RVS. In 40 of the 46 breasts, on the basis of second-look US/RVS assessments, we had increased the extent of resection (BCS with wider margins 18, Mastectomy 22). As a result, the rate of positive margins after BCS was 13% and the presence of invasive component on the margin was only 1%.
Conclusion: Our results suggest that the improved detection rate of the additional MRI lesions by second-look US with RVS can lead to the reduction of positive margins after BCS.

B-0463 14:18

Predictive value of posterior acoustic features in the biological behaviour of breast tumours

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Purpose: To evaluate the association between the sound-attenuating properties of breast cancer with tumor grade, hormone receptors expression, ERRB2 oncogene and ki -67 marker, as well as to assess the predicting value of these features.
Methods and Materials: The posterior acoustic properties of 138 breast cancer ultrasound images obtained between January and December 2012 were reviewed and correlate with tumor grade, estrogen/progesterone receptor expression, ki-67 and ERRB2 receptor status. These posterior acoustic features were classified into shadowing, enhancement, mixed pattern and no change.
Results: Of the 22 CDI with grade III, 77.3 % had posterior enhancement, while 13.6% had posterior shadowing. There were 23 lesions with negative estrogen receptors, of which 87.0 % had posterior enhancement and 8.7 % had posterior shadowing, with statistically significant difference. Also, of the 32 patients with negative progesterone receptors there was observed a higher proportion of lesions with posterior enhancement (65.6 %) and only 15.6 % had posterior shadowing. Of the 18 lesions with high expression of ki-67, 72.2% had posterior enhancement and 11.1% had posterior shadowing. There were no significant differences between tumor grades I and II and acoustic features, nor with ERRB2 oncogene.
Conclusion: The presence of posterior enhancement is strongly associated with a higher tumor grade and higher risk of being estrogen and progesterone receptor negative as well as greater expression of Ki -67 marker.

B-0464 14:27

Role of targeted-ultrasonography in further assessing incidentally detected breast lesions at dynamic magnetic resonance imaging

R.O. Stroie, V. Londero, A. Gualano, R. Girometti, C. Zuiani, M. Bazzocchi; *Udine/IT (rstroie@yahoo.com)*

Purpose: To investigate the role of targeted-ultrasonography (targeted-US) in identification and characterisation of incidental enhancing lesions on breast dynamic-Magnetic Resonance Imaging (dynamic-MRI).
Methods and Materials: We retrospectively reviewed 2500 consecutive breast dynamic-MRI during a 2-year period, identifying 142 incidental enhancing lesions categorised as 3, 4, 5 on BI-RADS MRI lexicon. Correlations between MRI lesion characteristics, histopathologic findings and US detection rate were analysed. The reference standard was histopathologic examiantion after needle biopsy or surgical excision in 102 of 142 (72%) lesions and follow-up (≥24 months) in 40/142 (28%). Statistical analysis used Chi-square test.
Results: US correlation was made in 104/142 (73%) lesions. Higher US detection rate was observed for masses (84/104 [81%]) rather than non-masses (12/21 [57%]) (p=0.04), for MRI BI-RADS category 4-5 (51/62 [82%]) rather than category 3 (53/80 [66%]) (p=0.036). Targeted-US equally identified malignant and benign lesions [46/63 (73%) and 58/79 (73%)]. 8 of the malignancies were assessed as MRI BI-RADS 3 and 38 as MRI BI-RADS 4-5, in concordance to the presumed US suspect pattern. Sonographic correlation was also higher in invasive (39/50 [78%]) compared to non-invasive (7/13 [54%]) malignancies (p=0.15) although any statistically significant difference. Sensitivity, specificity, positive and negative predictive values regarding the US second-look, were respectively, 82%, 69%, 68% and 83%.
Conclusion: Targeted-US identifies most of the incidental enhancing breast MRI lesions, especially those assessed as masses with a high grade of suspicion that necessitate further characterisation with US-guided needle biopsy. The lack of an US correlate does not obviate the need for biopsy.

B-0465 14:36

Can transmission-ultrasound tomography detect small lesions in dense breasts?

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Purpose: To examine whether the novel 3D diagnostic imaging technology of transmission-ultrasound tomography (TUT) can detect small lesions (< 10 mm) in dense breasts of 112 BI-RADS 4 volunteers (ACR 3 or 4).
Methods and Materials: The TUT system performs 3D tomography of the pendulant breast using transmission ultrasound (distinct from conventional echo-mode ultrasound) in a fixed-coordinate system. Design details were presented in ECR 2011 and 2012. TUT constructs multiple images for each coronal slice, using measurements of refractivity and frequency-dependent attenuation and dispersion, which are combined to form the composite index (CI) of each tissue voxel. High values of CI index are used for detection and differentiation of breast malignant lesions. Initial results were published in European Radiology (Feb. 2013). This study is focused on dense breasts of 112 BI-RADS 4 female volunteers (ages 36-78) and examines the CI values of 34 malignant and 78 benign lesions (sizes 2-10 mm, median of 6.2 mm) confirmed by histopathology of biopsy samples.
Results: The CI values of malignant lesion voxels were above 1.04, which is the cut-off point in the distribution of CI values of normal breast tissue and benign lesion voxels, whilst 99.9% of normal tissue voxels had CI values < 0.56. This allows detection and differentiation of breast lesions with high statistical significance.
Conclusion: Initial results indicate the potential of TUT to detect and classify small breast lesions (< 10 mm) in women with dense breasts at high statistical significance level. Further testing of this promising result is suggested.
Author Disclosures:
V.Z. Marmarelis: Founder; Marmarelis. Patent Holder; Marmarelis. Shareholder; Marmarelis.

B-0466 14:45

Technical quality assurance in mammasonography within the Austrian mammography-screening pilot project: concept and first results

S. Wildner[1], R. Mittasch[2], F. Semturs[1], C. Kollmann[1]; [1]*Vienna/AT*, [2] *Wels/AT (sonja.wildner@meduniwien.ac.at)*

Purpose: Ultrasound quality assurance is often regarded as not efficient or too cost-intensive among radiologists. As part of the Mammography Screening Program starting in Austria, ultrasound is included in primary diagnostics which is unique for European Mammography Screening Programs. Hence, Technical Quality Assurance has to be performed for ultrasound devices as well as for mammography devices. While mammography TQA follows certain protocols and guidelines especially designed for this purpose, no such documents exist for ultrasound so far.
Methods and Materials: A quality assurance test protocol for screening purposes was developed. Within this protocol simple and fast tests on a monthly basis should guarantee an optimal image quality and transducer performance. Only a few test images are acquired and evaluated by in-house software to quantify loss of elements, signal-to-noise-ratio, and penetration depth.
Results: Preliminary results obtained during the pilot phase of the program show that within 40 institutions comprising 49 ultrasound devices and 53 transducers 7 (13.5%) severe transducer failures were found which were not recognised by the radiologists.
Conclusion: We can prove that even without sophisticated and expensive aids such as phantoms it is possible to detect failures and thus improve image quality by using just simple settings. Technical quality assurance is essential in ultrasound diagnostics and need not be cost-intensive or complicated.

B-0467 14:54

Review of 3000 automated breast ultrasound scanners in dense-breasted women: analysis of results in the detection of benign and malign lesions

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Purpose: Our aim was to evaluate the use of automated 3D breast ultrasound in the detection of benign and malign lesions.
Methods and Materials: Four breast radiologists (experience range 9-35 years) reviewed 3,000 automated 3D ultrasound breast scanners in breast-densed women, who also underwent screening mammography. Patients with history of known breast cancer were excluded. A standardised scanning technique was performed by well-trained radiographers, thus allowing a decrease in undesired technical artefacts.
Results: 80% of the reviewed scanners were classified as benign or probably benign (BI-RADS 1 to 3) and 20% were classified as suspicious or malign (BI-RADS 4 and 5). Malign lesions were histologically proven. Multiplanar views allowed better characterisation of lesions: anatomical precise location (nipple and skin distance), clock position, shape, margins, ecogenicity, surrounding tissue changes and size. ABVS lessens interobserver variability when measuring lesions. Radiographers performed the scans, shortening the radiologist's reporting time (mean time 10 minutes per study).
Conclusion: Rate detection of benign and malign lesions using ABVS is similar to hand-held ultrasound. However, the use of multiplanar reconstructions allows better characterisation of lesion size and exact location, especially useful in follow-up of benign lesions. ABVS is a promising diagnostic method with good interobserver reliability. It increases breast cancer detection rate in breast-densed women when combined with adjoint mammography.

B-0468 15:03

Diagnostic performance of breast acoustic radiation force impulse imaging in the clinical setting

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(panagiotis.kapetas@meduniwien.ac.at)

Purpose: To evaluate quantitative breast acoustic radiation force impulse (ARFI) imaging in the clinical setting.
Methods and Materials: Fifty-eight patients (age range 21-82, mean age 51.7) receiving ARFI imaging (Virtual Touch, Siemens Acuson S3000, 9 MHz transducer) as part of their diagnostic ultrasound workup were investigated between june and september 2013. Two ARFI measurements of identified lesions were performed independently by two out of a pool of five different radiologists experienced in breast imaging. The measurement itself took 4 seconds. Regions of Interest (ROI) were placed into the lesion and the adjacent fatty tissue. The overall examination time was below 1 minute. ROC analysis was used for calculating diagnostic performance of ARFI measurements. The reference standard was either established by histopathology or imaging findings.
Results: There were 22 malignant and 36 benign lesions. Both ARFI measurements showed equal diagnostic performance as measured by the area under the ROC curve (0.780 and 0.783, respectively; $P > 0.05$). A cut-off value of ~3m/s revealed a sensitivity and specificity of 81.8/77.8% (measurement 1) and 85.3/61.1% (measurement 2).
Conclusion: ARFI provides quantitative data valid for differentiation between benign and malignant breast lesions. ARFI measurements are fast and can thus be implemented into routine ultrasound workup of breast lesions.

B-0469 15:12

Acoustic radiation force impulse imaging value in differentiating benign and malignant breast nodules

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(mafaldatmagalhaes@gmail.com)

Purpose: To evaluate the role of acoustic radiation force impulse imaging (ARFI) for the differential diagnosis between benignancy and malignancy of breast tumors.
Methods and Materials: The authors performed B-mode US and ARFI in 83 patients with breast lesions, subsequently characterised by percutaneous biopsy. Shear wave velocity (SWV) was obtained within the lesion and in the surrounding parenchyma (m/s). SWV measurements and lesion-to-parenchyma ratio (LTPR) were calculated. For differentiation between benignancy and malignancy receiver operating characteristic (ROC) curves were plotted for each parameter and cut-off values determined according to Youden's Index. Statistical significance was achieved if $p < 0.05$.
Results: A total of 92 breast lesions were included, (57 benign and 35 malignant nodules). Intra-lesional SWV was significantly higher for malignant neoplasms compared to benignancy (average of 9.14m/s vs. 3.45m/s; $p < 0.001$). LTPR was also significantly higher for malignant lesions (3.046 vs. 1.443; $p < 0.001$). No difference in parenchymal SWV was registered among groups (p=0.071). ROC curves revealed significant discriminative power for intra-lesional SWV [area under curve (AUC)=0.980; $p < 0.001$] and LTPR (AUC=0.950; $p < 0.001$). A cut-off value of 6.595m/s has a sensitivity and specificity of 88.6% and 96.4%, respectively. For LTPR a cut-off of 2.181 was found, providing a sensitivity of 88.6% and specificity of 91.1%.
Conclusion: Quantitative elasticity measurements may be used as a potential biomarker for characterisation of breast lesions reducing the number of unnecessary biopsies.

14:00 - 15:30 **Room G/H**

Genitourinary

SS 607

Gynaecological and bladder tumours

Moderators:
C.D. Alt; Heidelberg/DE
R. Manfredi; Verona/IT

B-0470 14:00

Semi-quantitative dynamic contrast-enhanced (DCE) MRI in preoperative staging of patients with cervical carcinoma: preliminary results

A.C. Cadonici, D. Ippolito, P. Bonaffini, O. Minutolo, V. Besostri, S. Sironi;
Monza/IT (a.cadonici@gmail.com)

Purpose: To assess the value of semiquantitative DCE parameters in cervical cancer to find any difference between neoplastic tissue and normal cervical tissue, being tumour grade the standard of reference.
Methods and Materials: Thirty patients with cervical cancer were enrolled in our study. Scanning protocol included multiplanar T1- and T2-weighted TSE and 10 dynamic T1-weighted GE sequences obtained during the administration of contrast medium (overall time: 5 minutes and 66 s). Perfusion colour maps were generated on a dedicated software and two regions of interest (ROIs) were manually drawn on the tumour and on normal cervical tissue to generate time-signal intensity curves. Relative enhancement (RE%), maximum enhancement (ME%), maximum relative enhancement (MRE%) and time to peak (TTP) were calculated and statistically analysed both for neoplastic and normal cervical tissues.
Results: Semi-quantitative analysis showed the following perfusion values for cervical cancer: RE: 92.26%±49.34; ME: 1123.96%±679.70; MRE: 96.48%±58.29; TTP: 201.91s±79.79. Corresponding values calculated in cervical tissue were: RE: 148.31%±52.39; ME: 1620.23%±470.05; MRE: 148.54%±52.43; TTP: 235.24s±72.04. RE, ME and MRE were significantly ($p < 0.05$) lower in neoplastic tissue compared to cervical tissue. ME, MRE and RE were also higher in G1 than in G2-G3 tumours.
Conclusion: Perfusion parameters differ significantly between cervical cancer and normal cervix; moreover, tumour perfusion parameters proved to decrease according to tumour grade.

B-0471 14:09

Value of diffusion-weighted imaging in predicting parametrial invasion in stage Ia2-IIa cervical cancer

C. Jeong[1], J. Park[1], C. Kim[1], S. Park[1], B. Park[1], B. Kim[2], S. Kwon[1], M. Cha[1], H. Kim[1]; [1]*Seoul/KR*, [2]*Rochester, MN/US (iamhis27@gmail.com)*

Purpose: We investigated the value of diffusion-weighted imaging (DWI) in evaluating parametrial invasion (PMI) in stage IA2-IIA uterine cervical cancer.
Methods and Materials: A total of 117 patients with stage IA2-IIA uterine cervical cancer who underwent preoperative MRI and radical hysterectomy were included. Preoperative clinical variables such as age, serum squamous cell (SCC) antigen level, FIGO stage, and biopsy results and MRI variables including tumor size, tumor ADC, presence or absence of PMI or lymph node metastases were analysed and compared between the groups with and without pathologically proven PMI.
Results: Pathologic PMIs were identified in 32% of patients (37/117). All variables except age were significantly different between patients with and without pathologic PMI (all $P < 0.05$). All variables except serum SCC antigen were also significantly correlated with pathologic PMI on univariate analysis (all $P < 0.05$). Multivariate analysis indicated that PMI on MRI ($P < 0.001$) and tumor ADC ($P = 0.029$) were independent predictors of pathologic PMI. The area under the curve of PMI on MRI increased significantly from 0.793 to 0.872 when combined with tumor ADC ($P = 0.002$). The false negative rate (FNR) of PMI on MRI was 10.1% (7/69). When samples were further stratified with tumor ADC, the FNR decreased to 2.0% (1/49).
Conclusion: In stage IA2-IIA cervical cancer, tumor ADC and PMI on MRI seem to be independent predictors of pathologic PMI. Combining the two predictors improved the diagnostic performance of the identification of patients at low-risk for pathologic PMI.

B-0472 14:18

Comparison of magnetic resonace imaging and transvaginal ultrasound in the staging of invasive cervical cancer

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Purpose: The aim of this prospective study was to compare the diagnostic accuracy of transvaginal ultrasound (TVS) with magnetic resonance imaging (MRI) in the staging of invasive cervical cancer using surgical histology as the gold standard.
Methods and Materials: This was a prospective, operator-blinded, interdisciplinary study conducted at a national centre for gynaecological cancer. We enrolled consecutive patients diagnosed with invasive carcinoma of the cervix during the period January 2011 to July 2013 (47 patients). All patients underwent MRI and TVS according to a standardised protocol.
Results: TVS correlated strongly with MRI in the assessment of tumor size. Sensitivities and specificities for the detection of stromal invasion were 100% and 55% and 100% and 65% for MRI and TVS respectively. No significant difference was detected (p value = 0.48). MRI had a false positive rate of 22% in the assessment of parametrial invasion with TVS correctly down staging 6 patients from stage IIb to Ib.
Conclusion: Accurate staging of cervical cancer is essential as it directs both treatment strategies and guides prognosis. TVS offers the advantages over MRI of being relatively inexpensive, non-invasive and potentially widely available. We have shown TVS to have a similar diagnostic accuracy to MRI and suggest that transvaginal ultrasound could be used as a first-line imaging modality to stage invasive cervical cancer. TVS performed by a dedicated gynaecological radiologist can be a feasible and economic imaging modality with a diagnostic accuracy comparable to that of MRI.

B-0473 14:27

MRI of endometrial carcinoma: comparison between T2-weighted, contrast-enhanced T1-weighted and diffusion-weighted sequences

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Purpose: To compare the accuracy of T2-weighted, contrast-enhanced T1-weighted and diffusion-weighted MR images (T2-WI, CET1-WI and DWI) in the assessment of myometrial and cervical stromal infiltration by endometrial carcinoma (EC).
Methods and Materials: Fifty patients with histologically proven EC who underwent preoperative MRI and surgery at our Institution over a 30-month period have been included in our retrospective study; informed consent was waived. Two radiologists independently evaluated T2-WI, CET1-WI and DWI of each patient and assessed: depth of myometrial invasion (more/less 50%) and presence of cervical stromal infiltration (Yes/No); a pathologist reviewed histological specimens by considering the same variables. Radiological findings have been compared with pathological ones by means of Fisher's exact Test.
Results: At histology, myometrial infiltration was 50% in 17/50 (34%); at MRI, myometrial infiltration was correctly assessed in 43/50 (86%) of the cases when evaluating T2-WI, in 43/50 (86%) when evaluating CET1-WI and in 45/34 (90%) when evaluating DWI (P> 0.05). At histology, cervical stromal infiltration was present in 9/50 (18%) of the cases and absent in 41/50 (82%); at MRI, cervical stromal infiltration was correctly assessed in 46/50 (92%) of the cases when evaluating T2-WI, in 46/50 (92%) when evaluating CET1-WI and in 46/50 (92%) when evaluating DWI (P> 0.05).
Conclusion: No statistically significant differences have been found in the accuracy of T2-WI, CET1-WI and DWI in evaluating myometrial and cervical stromal infiltration by endometrial carcinoma; therefore, DWI may replace CET1-WI, always in addition to the more "anatomical" T2-WI, for "T" staging of endometrial carcinoma.

B-0474 14:36

Conventional MR imaging combined with perfusion and diffusion weighted imaging in the pre-operative assessment of endometrial cancer

A.C. Cadonici, D. Ippolito, O. Minutolo, P. Bonaffini, M. Colombo, S. Sironi; *Monza/IT (a.cadonici@gmail.com)*

Purpose: To assess the role of semiquantitative DCE and quantitative DWI parameters in patients with endometrial cancer for the evaluation of tumour aggressiveness, being tumour grading the standard of reference.
Methods and Materials: 60 patients with biopsy-proven endometrial cancer who underwent 1.5 T MR staging examination were prospectively enrolled. Imaging protocol included multiplanar T1 and T2 weighted TSE sequences,10 dynamic T1 weighted gradient echo sequences during the administration of Gadolinium (overall time:5 minutes and 66 seconds)and DWI sequences (b values:0 and 1000 mm2/sec).Colour perfusion and ADC maps were generated using a dedicated software.Relative Enhancement (RE %),Maximum Enhancement (ME %),Maximum Relative Enhancement (MRE %),Time To Peak (TTP %)and mean ADC values were calculated by manually drawing a region of interest (ROI)on neoplastic tissue and normal myometrium and then statistically analysed.
Results: Histopathological analysis confirmed the presence of endometrial carcinoma in all the patients.According to Wilcoxon signed rank test,neoplastic tissue showed significantly lower ($p < 0.001$) values of RE (64.57 %± 36.27);ME (889, 67 %± 449.96) and MRE (77.60% ± 38.13) as compared to normal myometrium (RE 153.39% ± 55.56; ME 1817.01% ± 707.22;MRE 159.89 %± 53.49).TTP was significantly higher in neoplastic lesion than in normal myometrium (375.84 s± 1588.86 vs 195.72s ± 76.74). Mean ADC value of neoplastic tissue was 781.60 ± 233.09 x 10-3 mm2/s, significantly lower ($p < 0.001$) than in myometrium (1594.20 ± 375.0 x 10-3 mm2/s).Moreover ME and RE showed higer perfusion values in G1 tumors than in less differentiated lesions.
Conclusion: Perfusion parameters and mean ADC differ significantly between endometrial cancer and normal myometrium, potentially reflecting their different micorscopical features.

B-0475 14:45

Assessment of aggressiveness of epithelial ovarian cancers: correlation of apparent diffusion coefficient with histologic grade and clinical stage

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Purpose: The purpose of this study was to correlate the apparent diffusion coefficient (ADC) value of an epithelial ovarian cancer with histologic grade and postsurgical stage.
Methods and Materials: Forty-three patients with pathologically proven epithelial ovarian cancers, including well-differentiated carcinomas (WDC; n = 7), moderately differentiated carcinomas (MDC; n = 27), and poorly differentiated carcinomas (PDC; n = 9) were enrolled in this study. All patients underwent preoperative pelvic MRI including diffusion-weighted images with b value of 0 and 1000 s/mm^2 at 3.0-T unit. The mean ADC values of the solid portion of ovarian tumours were measured by two radiologists. Histologic grade and postsurgical stage were assessed. The mean ADC values of ovarian cancers were compared among the different histologic grades using one-way ANOVA. Independent sample t-test was used for the comparisons of ADCs between early stage tumour (FIGO stage I) and advanced tumour (FIGO stage II, III, and IV).
Results: The mean ADC values of the solid portion of epithelial ovarian cancers significantly differed between those of WDC and MDC (p=0.013), WDC and PDC (p=0.010). However, there was no significant difference between those of MDC and PDC (p=0.983). A significant difference was found in the mean ADC values between early stage cancers and advanced cancers (p=0.011). The mean ADC values showed significant correlation with histologic grade (rho=-0.446, p=0.003) and postsurgical stage (rho=-0.425, p=0.005).
Conclusion: The mean ADC values of the solid portion of epithelial ovarian cancers strongly correlate with histologic grade and postsurgical stage.

B-0476 14:54

Impact of ADNEXMR SCORING system on the clinical management of adnexal masses

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Purpose: To retrospectively apply the MRI scoring system (ADNEXMR SCORING system) designed for characterisation of indeterminate adnexal masses to assess its value in clinical practice.
Methods and Materials: Our study population comprised 394 women (mean age:45, range:18-88) having 497 adnexal masses, who underwent MRI between January 2008 and October 2010. Surgical pathology or at least a one-year imaging follow-up for each patient was recorded. Blinded to final diagnosis, patients were stratified into five categories according the ADNEXMRSCORE. According to the ADNEXMRSCORE, patients classified as ADNEXMRSCORE2 and 3 would have been managed with follow-up scans whereas patients classified as ADNEXMR SCORE 4 and 5 would have been operated. This theoretical ADNEXMRSCORE management was compared to the routine clinical management performed for each patient.
Results: Among patients scored as 2 or 3 (n=317), no cancer was found in masses larger than 6 cm. Excluding all patients with formal indication of surgical removal (symptomatic women (n=97), infertile (n=19) or personal history of ovarian malignancy (n=3)), surgery would have been avoided in 20/198 (10.1%), 29/198 (14.5%), and 44/198 (22.2%) women having adnexal masses lower than 4 cm, 5 cm and 6 cm, respectively. Among patients scored 4 or 5, treatment planning would have been changed in only 3/77 (3.9%) women who would undergo surgery for benign lesions.
Conclusion: Our study suggests that an optimal management could be achieved in patients with indeterminate adnexal masses when using ADNEXMR SCORING system, allowing a significant decrease (10%) of surgical recourse. A prospective study is required to confirm these data.

B-0477 15:03

Histogram analysis of apparent diffusion coefficient in urinary bladder lesions: correlation with pathological findings

S. Suo, X. Chen, Y. Fan, L. Wu, Q. Yao, J. Xu; *Shanghai/CN (shtsuo@gmail.com)*

Purpose: To determine if histogram analysis of apparent diffusion coefficient (ADC) can help differentiate bladder benign lesions from malignant lesions and distinguish bladder tumours of different T stages.
Methods and Materials: In all, 52 patients with bladder lesions, including benign lesions (n = 7) and malignant lesions (n = 45; T1 stage or less, 23; T2 stage, 7; T3 stage, 8; T4 stage, 7), were retrospectively evaluated. ADC maps were obtained at two b-value combinations (b = 0, 700 s/mm^2 and 0, 1500 s/mm^2). Parameters of histogram analysis of ADC included mean, kurtosis, skewness and entropy. The correlations between these parameters and pathological results were revealed.
Results: Significant differences were found in mean ADC values obtained at both b-value combinations among patients of different pathological groups ($P < 0.001$). For ADC maps obtained at b-value combination of 0 and 1500 s/mm^2, there were also statistically significant differences in kurtosis ($P = 0.009$) and skewness ($P = 0.039$), and the area under the receiver operating characteristic curve (AUC) for mean ADC was statistically significant in the differentiation of benign lesions and malignant lesions (AUC, 0.87; $P < 0.05$), and in the differentiation of T stages (AUC, 0.77-0.90; $P < 0.05$ for all comparisons). Kurtosis ADC was helpful for classifying stage T4 (AUC, 0.85; $P < 0.05$).
Conclusion: A combination of mean ADC and kurtosis ADC at b-value combination of 0 and 1500 s/mm2 is more accurate for assessment of bladder lesions of different pathological groups when compared with mean ADC alone.

B-0478 15:12

Estimation of bladder carcinoma histologic grade with diffusion-weighted MR imaging

H. Wang, Y. Guo, S. Li; *GuangZhou/CN (huanjun.wang@gmail.com)*

Purpose: To compare the diagnostic efficacy of the apparent diffusion coefficient (ADC) versus a normalised ADC (nADC) value in estimation of bladder urothelial histologic grade and to identify an optimal reference standard for nADC values in bladder tissue.
Methods and Materials: Thirty patients who underwent standard preoperative bladder DW-MRI examination (b=0.1000 s/mm^2) were recruited into the study between November 2011 and May 2013. In all cases urothelial carcinoma was confirmed by histopathology. ADC was obtained for each tumour. Reference tissues from urine in bladder lumen, the obturator internus and gluteus maximus were used to evaluate nADC which was calculated as: ADC (tumour lesion)/ADC (reference standard). A receiver operating characteristic curve (ROC) was constructed for each of the three nADC tissues and their ability to differentiate between high- and low-grade bladder carcinoma were compared to identify an optimal reference standard for nADC calculation.
Results: The ADC (mean±SD) for low- and high-grade bladder carcinoma were 1.112±0.159 and 0.772±0.091, respectively ($P < 0.001$). The area under the ROC curve of the ADC were 0.985, 0.995, 0.960 and 0.945, respectively in bladder tumour, urine, obturator internus and gluteus maximus ($P < 0.001$).
Conclusion: DW-MRI can be used to non-invasively estimate the histological grade of bladder urothelial carcinoma. Urine in bladder lumen can be used as an ideal reference standard for nADC calculation. The differential diagnostic efficacy of nADC is superior to that of the ADC value.

B-0479 15:21

Value of MDCT in the detection of lymph node metastases in patients with carcinoma of the urinary bladder: correlation of imaging and histopathological findings in 274 patients

T. Zahel, T. Maurer, T. Horn, E.J. Rummeny, K. Holzapfel; *Munich/DE (tinazahel@googlemail.com)*

Purpose: To evaluate multi-detector computed tomography (MDCT) in the detection of lymph node metastases in patients with urothelial carcinoma of the urinary bladder.
Methods and Materials: Two-hundred and seventy-four patients with urothelial carcinoma of the bladder were preoperatively scanned by MDCT (sensation 64, siemens; portal venous phase of abdomen and pelvis). Based on anatomical levels, a 12-field-based approach was used independently by two radiologists to analyse the presence of lymph node metastases on CT scans. Lymph nodes were classified using a 5-point scale (1: definitely benign 2: most likely benign 3: uncertain 4: most likely malignant 5: definitely malignant). Results from radiological analysis were correlated with findings of histopathological results after radical pelvic lymphadenectomy in all patients. Correlations were performed on a field and patient basis.
Results: In 65 of 274 patients (24%), lymph node metastases were confirmed by histopathological analysis. On a patient basis, sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and accuracy of MDCT in the detection of lymph node metastases were 65%, 93%, 90%, 73%, and 79%, respectively. Using the field-based method, 1983 fields of 274 patients could be evaluated. Of these, 140 fields (7%) included lymph node metastases. Sensitivity, specificity, PPV, NPV, and accuracy were 52%, 98%, 96%, 67%, and 75%, respectively, with this method.
Conclusion: MDCT was not sensitive, but highly specific in the detection of lymph node metastases in patients with urothelial carcinoma of the bladder.

14:00 - 15:30 **Room I/K**

Neuro

SS 611

Brain tumour staging and therapy

Moderators:
K. Ahlström Riklund; Umea/SE
S. Bisdas; Tübingen/DE

B-0480 14:00

Diffusion kurtosis imaging in grading of brain glioma malignancy

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Purpose: Diffusion kurtosis imaging (DKI) has been introduced as an advanced extension of diffusion tensor imaging (DTI). DKI characterises the diffusion deviation degree from the Gaussian model. The goal of this study is to assess the diagnostic efficacy of DKI in glioma grading.
Methods and Materials: 29 patients with cerebral gliomas underwent imaging with a 3-T MR scanner. A spin-echo EPI sequence was used to acquire DKI using b values of 0, 1000 and 2500 s/mm² and 60 gradient directions. The DT parameters (mean diffusivity (MD), axial diffusivity (AD), radial diffusivity (RD), fractional anisotropy (FA), relative anisotropy (RA)) and the DK parameters (mean kurtosis (MK), axial kurtosis (AK), radial kurtosis (RK), kurtosis anisotropy (KA)) were compared in the solid parts of 14 low-grade gliomas (LGG), and 15 high-grade gliomas (HGG) ($P < 0.05$ significance level, t-test).
Results: MK, AK, RK, KA for HGG and LGG were 0.677±0.309, 0.613±0.239, 0.718±0.390, 0.115±0.113 and 0.462±0.117, 0.442±0.108, 0.447±0.174, 0.039±0.017, respectively. DK parameters significantly differed between gliomas grades (MK, P=0.02; AK, P=0.02; RK, P=0.025; KA, P=0.02). MD, AD, RD, FA, RA for HGG and LGG were 1.382±0.577 (×10-3 mm2/sec), 1.564±0.593 (×10-3 mm2/sec), 1.168±0.606 (×10-3 mm2/sec), 0.151±0.112, 0.090±0.070 and 1.867±0.394 (×10-3 mm2/sec), 2.040±0.437 (×10-3 mm2/sec), 1.780±0.379 (×10-3 mm2/sec), 0.083±0.042, 0.053±0.022, respectively. FA significantly increased with higher malignancy (P=0.04), whereas MD, AD and RD significantly decreased with that (P=0.01, 0.02, 0.003, respectively). The highest sensitivity and specificity for discriminating between HGG and LGG were found for MK (93% and 94%, respectively).
Conclusion: DKI demonstrated a promising potential to differentiate among glioma grades and provides added value in comparison with conventional DTI.

B-0481 14:09

Glioma grading based on perfusion MRI: a normalised blood volume histogram metrics quantification study

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Purpose: To compare the diagnostic accuracy of normalised Blood Volume (nBV) histogram metrics to differentiate low from high grade gliomas.
Methods and Materials: Forty nine patients (22 female, 27 male) with histologically confirmed gliomas were included. Group A comprised 13 patients with low grade gliomas (all grade II) while group B comprised 36 patients (4 grade III and 32 grade IV). Three-dimensional tumor segmentation was based on intensity level clustering in T2 FLAIR for the non enhancing lesions or post contrast T1 weighted images for the enhancing lesions. Dynamic Susceptibility Contrast (DSC) perfusion was applied in all patients. Leakage corrected nBV maps were created from all pixels included in the tumor volume. Minimum, maximum, mean, standard deviation, median, 5%, 30%, 70% and 95% percentiles, as well as, normalised peak height of the nBV histograms were calculated for both groups. Resulting nBV histograms were analysed for each patient to calculate the area under the curve of receiver operating characteristics (AUROC) for the above mentioned histogram metrics.

Results: Both V30 (threshold value: 0.478) and Median (threshold value: 0.671) histogram metrics were resulted in 86.11% sensitivity and 100% specificity, to discriminate high form low grade gliomas, however the V30 AUROC was higher than that of Median (0.949 and 0929, respectively).
Conclusion: Normalised Blood Volume histogram analysis is an accurate method for the differentiation between low and high grade gliomas.
Author Disclosures:
K. Nikiforaki: Employee; N. Papanikolaou & Associates. **N. Papanikolaou:** CEO; N. Papanikolaou & Associates. Founder; N. Papanikolaou & Associates.

B-0482 14:18

Prognostic value of apparent diffusion coefficient (ADC) values and its correlation with methylguanine-DNA-methyltransferase (MGMT) promoter methylation status on glioblastoma multiforme (GBM)
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Purpose: To analyse whether apparent diffusion coefficient (ADC) values correlate with survival and with methylguanine-DNA-methyltransferase (MGMT) promoter methylation status on glioblastoma multiforme (GBM).
Methods and Materials: 57 patients with untreated GBM before surgery were analysed. Patients were followed-up for at least 12 months or until death. A ROI were drawn on ADC-map in the highest restriction region of the tumor and on the normal-appearing contralateral white matter (NCWM). ADCmin-values were evaluated as well as ADC-index defined as a ratio between tumoral ADCmin and NCWM-ADCmean. MGMT-status, tumoral volume, residual volume, progression-free survival (PFS) and overall survival (OS) were evaluated. Three groups were analysed, Group1=ADC-index> 0.7 and MGMT-methylated-status, Group2=ADC-index< 0.7 and MGMT-non methylated-status, and Group3=MGMT-non-methyltaed-status independent of ADC-index. Kaplan-Meier and Cox-regression model were performed.
Results: 57 patients were evaluated. 46 patients had complete resection. Presurgical tumoral volume (mean=42.4 cm^3) and post-surgical volume (mean=0.57 cm^3) had no association with survival. MGMT-status (n=53) was not methylated in 26. On Kaplan-Meier analyses MGMT-status correlated better with PFS ($p < 0.001$), while ADC-index correlate better with OS ($p < 0.001$). Group1 had better prognosis than Group2 in PFS (p=0.014) and OS ($p < 0.001$). In Group3, ADC-index> 0.7 had better OS than ADC-index< 0.7 (p=0.027). Patients with MGMT-methylated-status and ADCindex< 0.7 had worse OS than patients with ADCindex> 0.7 ($p < 0.001$). The ADC-index value of 0.7 represents the best cut-off value for predicting OS. ADC-index was a significant predictor variable on Cox regression model (p0.003).
Conclusion: The combined use of ADC-index and MGMT-status are stronger predictors than using separated in GBM. ADC-index value is a new prognostic parameter in GBM.

B-0483 14:27

MGMT promoter methylation status is associated with specific imaging features and MR imaging quantitative parameters in high-grade gliomas
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Purpose: To retrospectively evaluate the relationship between the MGMT methylation status and the quantitative imaging parameters of MR in HGGs.
Methods and Materials: 24 patients whose MGMT promoter methylation status was available were enrolled retrospectively. MR examinations were performed before surgery. ADC and FA from DTI, and the regional cerebral blood parameters from PWI and parameters from IVIM were measured for enhancing tumours.
Results: ADC values tended to be higher in the methylated HGGs than in the unmethylated HGGs ($p = 0.055$), the ADC ratio was significantly higher in the methylated tumours versus the unmethylated tumours ($p = 0.032$). The FA and FA ratio showed significantly lower values in the methylated HGGs as compared with those in the unmethylated HGGs ($p = 0.006$ and $p = 0.007$). The f values of methylated HGGs (0.156 ± 0.039 [standard deviation]) were significantly larger than those of unmethylated HGGs (0.066 ± 0.031) (P =.003). The D* values of unmethylated HGGs (21.99 x 10-3 mm2/sec ± 19.01) were significantly smaller than those of methylated HGGs (42.64 x 10-3 mm2/sec ± 20.17) (P =.022). Regarding imaging features, only ill-defined margin was seen more frequently in the methylated group than in the unmethylated group (45.5% versus 7.7%, respectively, $p = 0.048$).
Conclusion: MGMT promoter methylation status is associated with a specific imaging feature (an ill-defined margin) and several imaging parameters (a higher ADC, lower FA and higher perfusion parameters) of HGGs.

B-0484 14:36

Comparison of diffusion tensor, dynamic susceptibility contrast MRI and ^{99m}Tc-Tetrofosmin brain SPECT for the detection of recurrent high-grade glioma
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Purpose: Treatment-induced necrosis is a relative frequent finding in patients treated for high-grade gliomas. Differentiation by imaging modalities between glioma recurrence and treatment-induced necrosis is not always straightforward. Herewith, we compared diffusion tensor, dynamic susceptibility contrast MRI and ^{99m}Tc-Tetrofosmin brain SPECT for the differentiation of glioma recurrence from treatment-induced necrosis.
Methods and Materials: We prospectively studied 30 patients who were treated for high-grade glioma and had a suspicion of recurrent tumour on follow-up MRI. All patients received surgical resection of the tumour, followed by postoperative standard radiotherapy with chemotherapy. No residual tumour had been found in the imaging follow-up immediately after initial treatment. All patients underwent brain MRI and within a week underwent ^{99m}Tc-Tetrofosmin brain SPECT.
Results: Both ^{99m}Tc-Tetrofosmin brain SPECT and dynamic susceptibility contrast MRI could discriminate the two clinical entities with 100% sensitivity and 100% specificity. An ADC ratio cut-off value of 1.27 could differentiate recurrence from treatment-induced necrosis with 65% sensitivity and 100% specificity and a FA ratio cut-off value of 0.47 could differentiate recurrence from treatment-induced necrosis with a 57% sensitivity and 100% specificity. A significant correlation between ^{99m}Tc-Tetrofosmin uptake ratio and rCBV was found (P=0.002). A significant negative correlation was also found between ^{99m}Tc-Tetrofosmin uptake ratio and ADC ratio (P=0.031).
Conclusion: Dynamic susceptibility contrast MRI and brain SPECT with ^{99m}Tc-Tetrofosmin had the same accuracy and may be used to detect recurrent tumour. DTI also showed promise for the detection of recurrent tumour, but was inferior to both dynamic susceptibility contrast MRI and brain SPECT.

B-0485 14:45

Differential diagnosis of therapy-related changes and recurrent intracranial tumours using perfusion MRI and methionine PET
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Purpose: Irradiation and chemotherapy may cause contrast enhancing tissue changes difficult to differentiate from a recurrent tumor. We evaluate the value of perfusion MRI and methionine PET in differential diagnosis of neoplastic and non-neoplastic changes.
Methods and Materials: 21 patients, treated earlier for an intracranial neoplasm, were recruited in the study after development of a new contrast enhancement. They underwent standard brain MRI and perfusion study with DSC technique at 1.5 T, and ^{C11}methionine PET. The diagnosis was confirmed histologically or with a long time follow-up. Patients with insufficient follow-ups or inconclusive final diagnosis (stable lesions in patients receiving temozolomide during follow-up) were excluded. The final material consisted of 16 patients who had 19 lesions. Ten of the lesions were neoplastic (all histologically confirmed) and nine lesions were non-neoplastic. The lesion was recorded as neoplastic on perfusion MRI if the RBV ratio of the lesion/the same area in the healthy side was > 2 and on PET if the lesion/normal cortex ratio was ≥2.0.
Results: 14/19 lesions (74%) were correctly diagnosed on perfusion MRI and 15/19 lesions (79%) on PET. Sensitivity and specificity for neoplastic lesions were 80% and 67% on perfusion MRI and 100% and 56% on methionine PET, respectively. Diagnosis was correct or false with both methods in 11 and 1 lesions, respectively, and discrepant in 7 lesions.
Conclusion: Accuracy of both methods is roughly the same. Methionine PET is highly sensitive for recurrent tumors but produces a lot of false positive diagnoses.

B-0486 14:54

Differentiation of true recurrence from delayed radiation therapy-related change of primary brain tumors using advanced MR imaging

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Purpose: To compare dynamic susceptibility contrast imaging, diffusion weighted imaging and susceptibility weighted imaging (SWI) for the differentiation of tumor recurrence and delayed radiation therapy (RT)-related change in patients treated with RT for primary brain tumors.
Methods and Materials: We enrolled 24 patients treated with RT for varoius primary brain tumors, who showed newly appeared enhancing-lesions 1year after completion of RT on follow-up 3 T brain MRI. The enhancing-lesions were confirmed as recurrence (n=14) or RT-change (n=10) based on radiological (n=11) or pathologic (n=13) findings. We calculated the mean values of normalised CBV (nCBV),ADC (apparent diffusion coefficient),and proportion of dark signal intensity on SWI (proSWI) for enhancing lesions. All values between two groups were compared using unpaired t-test. A multivariable logistic regression model was used to determine the best predictor of differential diagnosis between two groups. The cutoff value of the best predictor obtained from receiver-operating characteristic curve analysis was applied to the differentiation of RT-change and recurrence,and we obtained the sensitivity,specificity,and accuracy for the diagnosis.
Results: The mean nCBV values were significantly higher in recurrence group than RT-change group (2.64vs1.06;P=.004),and mean proSWI were significantly lower in recurrence group (4.37vs43.92;P <.001). However, no significant difference was observed in mean ADC values between two groups (P=.419). Results of multivariable logistic regression analysis showed that proSWI was the only variable that could be used to independently differentiate true recurrence from RT-change (P=.001); the sensitivity,specificity,and accuracy were 78.6%(11of14),100%(10of10),and 87.5%(21of24), respectively.
Conclusion: We found that the proSWI was the most promising parameter for the differentiation of newly developed enhancing-lesions more than 1year after RT completion in brain tumor patients.

B-0487 15:03

Evaluation of microvascular permeability with dynamic contrast-enhanced MRI for the differentiation of primary CNS lymphoma and glioblastoma: radiologic-pathologic correlation

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Purpose: Dynamic contrast-enhanced (DCE) MRI can provide in vivo assessment of the microvasculature in intracranial tumours. The aim of the present study was to evaluate the diagnostic performance of DCE-MRI derived vascular permeability parameters, including the volume transfer constant K^{trans}, the volume (V_e) of extravascular extracellular space (EES), and the flux-rate constant K_{ep} between EES and plasma, for the differentiation of primary CNS lymphoma (PCNSL) and glioblastoma (GB).
Methods and Materials: Sixty GB and ten PCNSL were included. Pre-treatment DCE-MRI with a 3D T1-weighted spoiled gradient-echo sequence was performed using Dotarem on a 3 T MRI scanner. Perfusion parameters (K^{trans}, K_{ep}, and V_e) were measured based on the Tofts-Kernmode model. Mann-Whitney-U test and receiver-operating characteristics (ROC) analysis were used to compare those parameters between PCNSL and GB. Histopathological correlation of DCE-MRI findings was performed using Tibor-Pap impregnation and CD31 immunohistochemistry.
Results: Median K^{trans} and K_{ep} values were significantly higher in PCNSL (0.148±0.060 and 0.401±0.089) than in GB (0.064±0.020 and 0.224±0.058) ($p < 0.01$, respectively). Median V_e values did not differ significantly between PCNSL (0.429±0.174) and GB (0.319±0.101). On ROC analysis, K^{trans} had the best discriminative value for differentiating PCNSL and GB (threshold: 0.093, sensitivity: 90.0%, specificity: 95.0%). Histopathological evaluation revealed intact vascular integrity in GB despite endothelial proliferation, whereas PCNSL demonstrated destructed vessel architecture, thereby promoting vascular disintegrity.
Conclusion: PCNSL demonstrated significantly higher K^{trans} and K_{ep} values compared with GB, implying a higher vascular permeability in PCNSL. These findings correlate with underlying histopathological features, and may be useful in distinguishing PCNSL from GB.

B-0488 15:12

Multiparametric characterisation of a rat model of glioblastoma by using MRI and 18 F-FDG PET/CT images

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Purpose: Glioblastoma is the most frequent primary brain tumour that carries a very bad prognosis despite the advances in treating human malignancies. This study aimed to characterise a rat model of glioma by MRI and PET/CT, the two versatile tools used in neuroimaging.
Methods and Materials: Male Wistar rats (N=19) implanted with C6 cells in their right caudate-putamen and Sham animals (N=5) were used and studied with MRI using a 7T system to acquire a T2, T2* and T1-weighted images to yield relaxation time maps, diffusion tension imaging-DTI to obtain mean diffusivity-(MD) and fractional anisotropy-(FA) maps, and magnetisation transfer-(MT) to determine MT ratio maps. Colour-based maps were computed using a home-made software developed in Matlab. ROIs were drawn in the tumoural tissue (TT), contralateral hemisphere (CH) and healthy tissue (HT). Six animals were also submitted to an 18 F-FDG-PET/CT, analysing ROI's in the T, CH and liver.
Results: TT compared with Sham showed significantly different values of MTR, T1, T2 and T2*. TT compared to CH was also significant on MTR, MD, T1, T2 and T2* measurements. When comparing TT and HT, there were significant differences on MT,FA, T1 and T2. PET/CT showed significantly higher SUVs on the TT than on CH. Correlation between SUVs and MRI parameters could not be found.
Conclusion: There are significant differences in MRI parameters related to inflammation, oedema and hypoxia between TT, CH and HT. 18 F-FDG-PET/CT provided new information to the MRI. Tumour characterisation can improve the selection of patients who will benefit from tailored therapies and their follow-up.

B-0489 15:21

Resection probability maps for quality assessment of glioma surgery without brain location bias

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Purpose: Intraoperative brain stimulation mapping reduces permanent postoperative deficits and extends tumour removal in resective surgery for glioma patients. Successful functional mapping is assumed to depend on the surgical team's expertise. In this study, glioma resection results are quantified and compared using a novel approach, so-called resection probability maps (RPM), exemplified by a surgical team comparison, here with long and short experience in mapping.
Methods and Materials: Adult patients with glioma were included by two centers with two and fifteen years of mapping experience. Resective surgery was targeted at non-enhanced MRI extension and was limited by functional boundaries. Neurological outcome was compared. To compare resection results, we applied RPMs to quantify and compare the resection probability throughout the brain at 1 mm resolution. Considerations for spatial dependence and multiple comparisons were taken into account.
Results: The senior surgical team contributed 56, and the junior team 52 patients. The patient cohorts were comparable in age, preoperative tumour volume, lateralization, and lobe localisation. Neurological outcome was similar between teams. The resection probability on the RPMs was very similar, with none (0%) of 703,967 voxels in left-sided tumours being differentially resected, and 124 (0.02%) of 644,153 voxels in right-sided tumours.
Conclusion: RPMs provide a quantitative volumetric method to compare resection results, which we present as standard for quality assessment of resective glioma surgery because brain location bias is avoided. Stimulation mapping is a robust surgical technique, because the neurological outcome and functional-based resection results using stimulation mapping are independent of surgical experience.

14:00 - 15:30 **Room L/M**

Cardiac

SS 603a

Functional MR imaging: myocardium and ventricles

Moderators:
D. Maintz; Cologne/DE
F. Molinari; Lille/FR

B-0490 14:00

Assessment of sub-clinical acute cellular rejection after heart transplantation: comparison of cardiac imaging and endomyocardial biopsy

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Purpose: Comparing the diagnostic value of multi-sequential cardiac magnetic resonance imaging (CMR) with endomyocardial biopsy (EMB) for detection of sub-clinical cardiac allograft rejection.
Methods and Materials: 146 examinations in 73 Patients (mean age 53±12 years, 58 male) were performed using a 1.5-Tesla scanner and compared to EMB results. A multi-sequential protocol was used including T2-weighted short tau inversion recovery (STIR) for calculation of the oedema ratio (ER), T1-weighted spin-echo sequence for assessment of global relative enhancement (gRE) and inversion-recovery sequences to visualise late gadolinium enhancement (LGE). Cut-off values were defined as <= 2 for ER and <= 4.5 for gRE. The presence of LGE was assessed qualitatively. A histological grade > 1B was considered as relevant rejection in which all patients received anti-inflammatory medical treatment.
Results: One-hundred and twenty-seven (127/146=87%) EMBs demonstrated with no or mild signs of rejection (grades <= 1 A) and 19/146 (13%) with a relevant rejection (grade >= 1B). Sensitivity, specificity, positive predictive (PPV) and negative predictive value (NPV) for rejection grade 1B or higher were as follows: ER: 63%, 78%, 30% and 93%; gRE: 63%, 70%, 24% and 93%; LGE: 68%, 36%, 13% and 87%; with the combination of ER and gRE with at least 1/2 positive: 84%, 57%, 23% and 96%. A receiver operator characteristic analysis revealed an area under the curve of 0.724 for ER and 0.659 for gRE.
Conclusion: CMR parameters for myocarditis were also useful to detect sub-clinical acute cellular rejection after heart transplantation. Comparable results to myocarditis could be achieved, with a combination of ER and gRE.

B-0491 14:09

Myocardial engraftment assessment of mesenchymal stem patches on serial high-resolution in vivo cardiac MR in chronic heart failure

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Purpose: To determine whether the efficiency of epicardial deposit of human bone marrow-derived mesenchymal stem cells (BMSC) fibrin patch on chronically-infarcted rat hearts occurred through integration of stem cells from the patch to the recipient myocardium.
Methods and Materials: BMSC were labeled with iron oxide nanoparticles (BMSC*, n=12) or unlabeled (BMSC-, n=10). Patches were applied to region of ischemia. No patch was applied to control group hearts after myocardial infarction and median sternotomy (SHAM, n=7). In vivo cardiac MR imaging was performed on a 4.7 Tesla scanner before, 8 days and 21 days after transplantation. Therapeutic efficacy was evaluated on cine flash MRI sequences with left ventricular ejection fraction (LVEF). Cell migration into the myocardium was evaluated on in vivo T2*-weighted sequences. The results were compared with histology for the evaluation of iron labeled cells (Perls) and immunohistochemistry for the presence of human cells (Lamin A/C).
Results: At day 8 and 21 after transplantation, a statistically significant difference was found between the LVEF of BMSC* and BMSC- compared with SHAM (p=0.02 and p=0.03 respectively). Persisting human cells were identified in the grafted area 21 days after transplantation. Location of dark areas identified on T2*-weighted MR images corresponded with spatially MR-matched histological sections and demonstrated that no BMSC* integrated in the myocardium.
Conclusion: The absence of integration BMSC into the recipient myocardium and the presence of persisting human cells at day 21 suggest that the efficiency of these constructs is more closely related to the paracrine effects of BMSCs.
Author Disclosures:
E. Blondiaux: Research/Grant Support; Société Française de Radiologie.

B-0492 14:18

Myocardial MR spectroscopy (MRS) as early indicator of athlete's heart and hypertrophic cardiomyopathy

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Purpose: To evaluate myocardial energetic metabolism with 31P-MRS and 1H-MRS in order to define early metabolic modifications in athlete's heart.
Methods and Materials: We prospectively performed a cardiac 1.5-T MR in 30 subjects: 15 athletes (A), 7 HCM patients (H) and 8 healthy volunteers (V). ECG-triggered true-FISP and 1H-MRS point resolved spectroscopy sequence were performed. For the 1H-MRS, a single voxel was placed into the septum. A 31P-MRS multivoxel chemical shift imaging sequence was acquired. 1H-MRS spectra were processed using jMRUI software; 31P-MRS spectra using Spectroscopy-Argus. Kruskal-Wallis and Jonckheere-Terpstra tests were used.
Results: Ejection fraction (%), indexed end-diastolic volume (ml/m^2), end-systolic volume (ml/m^2), mass (g/cm^2) and septal thickness (mm) were 65, 84, 31, 70 and 10 for group A, respectively; 68, 73, 20, 81 and 18 for group H, respectively; 63 (p=0.939), 78 (p=0.058), 29 (p=0.481), 45 (p=0.013) and 6 ($p < 0.001$) for group V, respectively. Creatine phosphate (PCr), γATP and inorganic phosphate (Pi) were 29, 5.5, 0.4 for group A, respectively; 22, 5.4, 0.4 for group H, respectively; 24 (p=0.281), 5.7 (p=0.877), and 0.0 (p=0.066) for group V, respectively. PCR/γATP was 5.1 in group A, 3.7 in group H and 4.6 in group V (p=0.441); total creatine was 0.4, 0.6, and 0.0, respectively (p=0.050); lipids were 0.1, 1.8, and 0.0, respectively (p=0.078).
Conclusion: A reduction of PCR/γATP ratio and an increase of lipids are confirmed in group H. A reduction of PCR/γATP associated with an increase of lipids could represent an indicator of early stage of HCM.

B-0493 14:27

Left ventricular non-compaction: pathological or normal variant?

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Purpose: There is considerable overlap between Left Ventricular Non Compaction and other cardiomyopathies, and it has been reported in up to 18% of athletes raising the question whether it is a distinct pathological entity. To further understand this unusual phenotype we assessed its prevalence in a healthy population using cardiac magnetic resonance (CMR).
Methods and Materials: 5000 volunteers > 45 yrs with no history of cardiovascular (CV) disease and a 10 year risk of CV disease less than 20% as assessed by the ASSIGN score were recruited to the Tayside Screening for Cardiac Events (TASCFORCE) study. Those with a B-type natriuretic peptide (BNP) level greater than their gender specific median were invited for a whole body cardiovascular MRI. From this group, 500 CMR were assessed, and LVNC ratios measured on the horizontal long axis and vertical long axis bSSFP sequences. Non compaction ratio was recorded at end diastole in the section with the greatest ratio of compacted to non compacted myocardium.
Results: The average non compacted:compacted LV myocardium was 1.79 (IQR 1.38-2.1) with the anterior wall of the mid LV the most common location of maximmum non compaction. 80 (16%) had a non compaction ratio of > 2.3 (the current proposed threshold for LVNC diagnosis). Of these the average non compaction ratio was 2.83 (IQR 2.45-3.05), with an average of 4 segments involved (IQR 3-6) using the AHA 17 segment model.
Conclusion: The current CMR criteria appears to over diagnose LVNC in healthy individuals and more stringent diagnostic criteria is required.

B-0494 14:36

Assessment of left ventricular functional and morphological adaptation in professional soccer players using cardiac MR

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Purpose: To investigate the effects of intensive daily training related to professional soccer on morphological and functional parameters of the left ventricle assessed by cardiac magnetic resonance imaging (CMRI) and to compare these to the observations in non-athletic healthy volunteers.
Methods and Materials: In 16 male professional soccer players from the German Bundesliga team squad of the Hamburger SV and six sedentary controls CMRI was performed at 1.5 T during active season. For quantitative CMRI, an electrocardiographically triggered steady-state free precession (SSFP) cine sequence (TR/TE, 3.2/1.6 ms; pixel-size, 1.7 mm×1.7 mm) was performed in short- and long-axis views. Quantitative analysis included the end-diastolic (EDV) and end-systolic volume (ESV), the stroke volume (SV), left ventricular ejection-fraction (EF) as well as the end-diastolic (EDMM) and end-systolic myocardial mass (ESMM). Statistical evaluation included Spearman`s correlation coefficient (CC) and the Wilcoxon test.

Results: In professional soccer players the EDV (230.8±20 ml vs. 168.99±42.48 ml; $p < 0.02$), ESV (101.1±16.65 ml vs. 68.28±15.81 ml; p=0.002) and SV (129.73±15.73 ml vs. 100.71±27.26 ml; $p < 0.05$) were significantly higher than in non-athletic volunteers. Furthermore, the myocardial mass was significantly higher in professional soccer players at the end-diastolic (152.28±37.72 g vs. 100.88±35.71 g; p=0.015) as well as the end-systolic (163.4±37.8 g vs. 114.4±39.3 g; $p < 0.03$) state whereas the ejection-fraction was similar in both collectives. At rest, the athlete`s heart rate was significantly lower (50 vs. 61 beats/min; p=0.01).
Conclusion: Left ventricular adaptations in professional soccer players are characterised by an increase in functional parameters and myocardial mass. CMRI allows for an objective quantitative assessment and might help to differentiate cardiac adaptations from hypertrophic cardiomyopathy.

B-0495 14:45

Cardiac MRI in elite athletes: can it be a final step in the eligibility for competitive sport after suspicious ultrasonography?
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Purpose: To evaluate usefulness and efficacy of CMR in young athletes with suspicious or inconclusive ultrasonography referring for their eligibility to competitive sport.
Methods and Materials: 29 athletes (high league football and hockey players, athletics; age 24±5; 27/2 men/women) were examined in 2009-2013. All athletes had suspicions to cardiac abnormalities according to the results of echocardiography, ECG and functional examination. CMR was performed with 1.5 T-scanner to detect/rule out LV hypertrophy, arrhythmogenic cardiomyopathy, myocarditis or congenital heart diseases.
Results: CMR didn't confirm cardiac pathology or found minor non-significant abnormalities in 16 cases (55.2%). In 5 cases (17.2%) CMR demonstrated the presence of bicuspid aortic valve with non-significant regurgitation. In 2 cases (6.9%) athletes had deep myocardial trabeculations without criteria of non-compaction cardiomyopathy. These athletes kept on doing competitive sports under the care of cardiologists. In 3 cases (10.3%) CMR revealed LV hypertrophy, which exceeded criteria established for the "athlete's heart". In 1 case of apical LV hypertrophy with focus of late-enhancement was found. These athletes were recommended to discontinue professional sport activities. 2 sportsmen (6.9%) were referred to cardiac surgeon: the first one had patent ductus arteriosus (Qp:Qs = 1.35:1), the second one - the complex cardiac pathology - non-compacted myocardium, ventricular septal and inferior wall aneurism, atrial septal defect (Qp:Qs = 1.35:1).
Conclusion: CMR provides significant contribution for medical decision-making in athletes eligibility for professional sport due to its possibilities in the assessment of ischemia and viability, evaluation of non-ischemic cardiomyopathies, myocarditis, pericardial disease, congenital heart disease and cardiac masses.

B-0496 14:54

MR 4D flow-based estimation of pulmonary arterial wedge pressure
U. Reiter, G. Reiter, G. Kovacs, A. Schmidt, H. Olschewski, M.H. Fuchsjäger;
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Purpose: To evaluate if time-resolved three-directional magnetic resonance phase contrast imaging (4D-MR-PCI) derived left atrial in- and out-flow patterns can be employed to estimate pulmonary arterial wedge pressure (PAWP).
Methods and Materials: 60 patients with suspected pulmonary hypertension (PH) underwent right heart catheterization for determination of pulmonary haemodynamics and 4D-MR-PCI of the left atrium. MR-PCI data were visualised with dedicated software and evaluated for peak velocities v_S and v_D of S- and D-wave of pulmonary veins at the pulmonary venous-left atrial junctions as well as for the peak velocity v_E of the E-wave at the left atrial-ventricular junction. Relations between peak velocities, left atrial acceleration index defined as $a_{LA}=2\cdot v_E/(v_S+v_D)$ and PAWP were analysed by means of correlation and linear regression analysis.
Results: Whereas no single peak velocity (mean v_S=34±12 cm/s, mean v_D=32±8 cm/s, mean v_E=50±16 cm/s) correlated strongly with PAWP (r=-0.57, -0.16 and 0.62 for v_S, v_D and v_E, respectively), the correlation coefficient between a_{LA} (mean a_{LA} =1.7±0.9) and PAWP was r=0.92. Linear regression of PAWP on a_{LA} did not depend on the presence of PH (p=0.61 for the intercept, p=0.87 for the slope) and the standard deviation from the regression line $PAWP=-3.6+8.5\cdot a_{LA}$ (in mmHg) was 2.0 mmHg.
Conclusion: 4D MR-PCI-derived left atrial acceleration index allows an accurate estimation of PAWP in patients with suspected PH and might, therefore, be employed as non-invasive marker for the pre- or post-capillary nature of cardiovascular disorders in general, and PH in particular.
Author Disclosures:
G. Reiter: Employee; Siemens AG.

B-0497 15:03

Towards non-invasive haemodynamic assessment of pulmonary hypertension
G. Reiter, U. Reiter, G. Kovacs, A. Schmidt, H. Olschewski, M.H. Fuchsjäger;
Graz/AT (gert.reiter@siemens.com)

Purpose: Mean pulmonary arterial pressure (mPAP), pulmonary arterial wedge pressure (PAWP), and transpulmonary pressure gradient (TPG) are haemodynamic key parameters for definition and classification of pulmonary hypertension (PH). The purpose of the present study was to analyse, if blood flow patterns derived from time-resolved three-directional magnetic resonance phase contrast imaging (4D-MR-PCI) can be used to estimate these parameters in patients with PH.
Methods and Materials: 33 patients with PH underwent right heart catheterisation providing mPAP, PAWP and TPG, as well as 4D-MR-PCI of the main pulmonary artery and the left atrium. Velocity fields resulting from 4D-MR-PCI were visualised with dedicated software and evaluated for (1) the duration of vortical blood flow (t_{vortex}) in the main pulmonary artery and (2) the left atrial acceleration index $a_{LA}=2\cdot v_E/(v_S+v_D)$ determined from three-dimensional peak velocities of systolic (v_S) and diastolic (v_D) pulmonary venous inflow and left atrial outflow (v_E). Relationships between invasively and non-invasively determined parameters were analysed by correlation, linear regression and Bland-Altman analysis.
Results: Strong correlations were found between mPAP and t_{vortex} (r=0.96) as well as between PAWP and a_{LA} (r=0.93). Linear regression equations $mPAP=15+0.66\cdot t_{vortex}$ and $PAWP=-3+8\cdot a_{LA}$ (both in mmHg) estimated mPAP and PAWP with standard deviations of 4 mmHg and 2 mmHg, respectively. The difference of estimated mPAP and PAWP strongly correlated with TPG (r=0.96) and resulted in a standard deviation of 4 mmHg between invasive and non-invasive assessment.
Conclusion: 4D-MR-PCI allows an accurate, non-invasive determination of the hemodynamic key parameters mPAP, PAWP and TPG in patients with PH.
Author Disclosures:
G. Reiter: Employee; Siemens AG.

B-0498 15:12

4D flow and cardiac MRI to estimate pulmonary arterial pressure: comparison with right-heart catheterisation in patients with pulmonary hypertension
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Purpose: Non-invasive method to estimate pulmonary artery (PA) pressure remains to be developed. We examined whether several parameters driven by 4D flow and cardiac MRI parameters allowed the estimation.
Methods and Materials: We enrolled 22 patients with pulmonary hypertension (pulmonary arterial hypertension, 5, chronic thromboembolic pulmonary hypertension, 17) and 4 normal volunteers for 4D flow and cardiac MRI. Using 4D flow MRI, the degree of vortex flow in the main PA flow was measured. Cardiac MRI parameters, including, right ventricular ejection fraction (RVEF), RV end-diastolic and end-systolic volume index, RV cardiac index, main PA diameter, and ratio of main PA to ascending aorta diameter (ratio PA) were documented. MRI findings were compared with catheter-driven mean PA pressure (mPAP) in the 22 patients.
Results: Vortex flow in the main PA was observed in all patients, but not in the volunteers. In the patients, the mean ± SD of mPAP and degree of vortex flow were 37.6 ± 11.0 mmHg and 67.0 ± 9.4%, respectively. The degree of vortex flow (Pearson's r=0.81, $P < 0.01$), ratio PA (r=0.51, P=0.02) and RVEF (r=-0.44, P=0.04) was correlated with mPAP. Other parameters were not correlated. Multivariate linear regression analysis demonstrated the degree of vortex flow was significantly associated with mPAP (coefficient=12.5, 95%CI, 4.7, 20.2, $P < 0.01$) but the remaining parameters were not.
Conclusion: Among several MRI parameters, the degree of vortex flow in the main PA demonstrated significant association with mPAP. 4D flow MRI was useful to estimate mPAP in patients with pulmonary hypertension.

B-0499 15:21

The prevalence of potentially serious incidental findings on cardiac MR imaging: a systematic review

L.M. Gibson, L. Paul, C.L.M. Sudlow; *Edinburgh/UK (lornagibson1@nhs.net)*

Purpose: To perform a systematic review to estimate the prevalence and types of incidental findings on cardiac magnetic resonance (MR) imaging to inform the design of the UK Biobank multi-modal imaging study of 100,000 middle-aged participants.
Methods and Materials: We searched authors' files, Medline and Embase for studies published in any language by June 2013 which reported the prevalence of incidental findings on cardiac MR in adult patients or apparently healthy volunteers. We defined serious incidental findings as those likely to threaten lifespan, quality of life or major body functions. One reviewer selected studies for inclusion and a second independently checked 10% of the references. We extracted data on incidental findings, participant characteristics and imaging variables.
Results: In 16 studies, 4,089 of 17,138 people (mean age 51 years, 42% female, 22% patients) had incidental findings, which were potentially serious in 699 (4.1%, 95% confidence interval 3.8-4.4%) including 415 suspected malignancies. The commonest non-malignant potentially serious incidental findings were pleural effusion (n=144), non-specific major parenchymal lung abnormality (n=23) and pulmonary consolidation (n=17). Potentially serious incidental findings were detected more frequently in studies using contrast compared to non-contrast imaging (5.6% versus 1.5%). One study (n=132) used a 3 T scanner, and the remainder used 1.5 T scanners.
Conclusion: Potentially serious incidental findings are common on cardiac MR. Over half are suspected malignancies. The potential for such findings should be discussed with research participants and patients when seeking informed consent. Investigators should design systems for evaluating incidental findings and referring patients to healthcare providers.
Author Disclosures:
L.M. Gibson: Research/Grant Support; Received funding from UK Biobank to attend educational meetings. **C.L.M. Sudlow:** Other; UK Biobank Chief Scientist.

14:00 - 15:30 **Conf. Room M3**

Interventional Radiology

SS 609

Trends in occlusive and aneurysmal disease

Moderators:
E. Dosa; Budapest/HU
D.K. Tsetis; Iraklion/GR

B-0500 14:00

The effect of sustained delivery of sirolimus on neointimal hyperplasia and the local thrombotic environment after angioplasty

Y. E[1], N. He[2]; [1]*Baoding/CN*, [2]*Tianjin/CN (eyajun@hotmail.com)*

Purpose: To explore the effect and potential problems of local sustained delivery of sirolimus for restenosis prevention after PTA.
Methods and Materials: Experimental common carotid artery injury model was established in the rat. Pluronic F-127 gel containing sirolimus was applied to the exposed adventitial surface of the injured carotid artery, and the effects of local sustained delivery of sirolimus for restenosis prevention after angioplasty were evaluated by haematoxylin and eosin staining and immunohistochemistry staining.
Results: 15 and 30 days after injury, compared to controls the neointimal thickness and area, the ratio of intimal area to medial area and the stenotic rate were significantly decreased in both high concentration (600 μg/100 μl) and low concentration (300 μg/100 μl) experimental groups ($P < 0.01$); Compared to controls, 15 and 30 days after injury local sustained delivery of sirolimus in both experimental groups enhanced the expression of the TF and PAI-1 in neointima ($P < 0.05$), however, the expression of t-PA in neointima was decreased in both high and low concentration groups ($P < 0.05$).
Conclusion: Local sustained delivery of sirolimus not only suppressed the neointimal hyperplasia effectively, but also induced the high expression of TF and PAI-1 and low expression of t-PA in neointima, and the imbalance expression of TF, tPA and PAI-1 could play an important role in late thrombosis formation after DES (drug eluting stent) placement.

B-0501 14:09

Calcium assessment and impact on drug eluting balloons in peripheral arterial disease

F. Fanelli, A. Cannavale, M. Corona, P. Lucatelli, A. d'Adamo, A. Wlderk, F.M. Salvatori; *Rome/IT (alessandro.cannavale@hotmail.com)*

Purpose: To assess the effect of calcium on the efficacy of DEB during revascularisation of steno-obstructive SFA lesions.
Methods and Materials: Sixty patients with de-novo lesions of the superficial femoral artery (SFA) underwent endovascular treatment with DEB. A pre-dilatation with conventional undersized (- 1 mm RVD) angioplasty balloon was done. DEB were selected according to vessel reference diameter (1:1) and keep inflated for 60 seconds. In case of residual stenosis > 50% or flow-limiting dissection a post-dilatation with conventional balloon or provisional stenting was done. Ankle-brachial index (ABI), late lumen loss (LLL), target lesion revascularisation (TLR), primary (PP) and secondary (SP) patency, major adverse events (MAE) and Rutheford shift were evaluated after a minimum follow-up of 1 year. Patients were divided in eight groups according to the amount of calcium: degree from 0° to 360°; length 3 cm.
Results: Recanalisation was done successfully in all cases. Flow-limiting dissection occurred in 5 cases (8.3%) with higher degree of calcium. It was solved with post dilatation in 3 cases and provisional stenting in the other 2. A less effect of DEB was observed in those patients with higher degree of calcium (> 270° vs. < 90°): ABI 0.71±0.07 vs. 0.92±0.07; LLL 0.75±0.21 vs. 0.45±0.10; PP 50% vs. 100%; SP 50% vs. 100%; TLR 25% vs. 0%; MAE 25% vs. 0%. According to the length of calcium, results were similar.
Conclusion: Calcium represents a barrier for optimal drug absorption. Circumferencial distribution seems to be the most influencing factor with worst effect noted in 360° calcium presence.

B-0502 14:18

Efficacy of drug eluting balloon percutaneous transluminal angioplasty to treat recurrent carotid in-stent restenosis: long-term results

C. Del Giudice, R. Gandini, V. Da Ros, S. Altobelli, E. Salvatori, E. Pampana, G. Simonetti; *Rome/IT (costantino.delgiudice@gmail.com)*

Purpose: To evaluate the potential role, safety and efficacy of drug eluting balloon for treatment of carotid in-stent restenosis (ISR).
Methods and Materials: 856 consecutive patients underwent carotid artery stenting from May 2002 to January 2008. In 41 patients a significant ISR (> 80% stenosis) occurred. Nine of these were affected by the onset of recurrent restenosis after multiple treatments within a short period of time. These patients were treated with DEB angioplasty to treat internal carotid artery ISR. An ultrasound controlwas performed at 1, 3, 6 and yearly after the procedure with mean follow-up time 36.6±2.7 months.
Results: A technical success was obtained in 100% of cases. A distal filter device was used in all cases. No major periprocedural neurological or myocardial events were recorded. Angiographic stenosis decreased from 87%±4% to 6±4%. Peak systolic velocity (PSV) decreased significantly after the procedure from 4.7±1.5 to 1.3±0.5 m/s. PSV maintained under a significant values during the follow-up except in one patient, who developed a significant ISR 3 years after the procedure. TVR was 9% at 36 months follow-up. No neurological or myocardial events were recorded during the follow-up. 1 patient died at 3 months follow-up.
Conclusion: DEB may have a potential role, improving outcomes of patients treated for carotid ISR.

B-0503 14:27

An echo-color-doppler analysis - carotid endarterectomy vs stenting: does the flow really change?

P. Lucatelli[1], F. Fanelli[1], A. Cannavale[1], C. Cirelli[1], M. Corona[1], A. d'Adamo[1], C. Catalano[1], F.M. Salvatori[1], L. Saba[2]; [1]*Rome/IT*, [2]*Cagliari/IT (pierleone.lucatelli@gmail.com)*

Purpose: To assess potential hemodynamic differences after Carotid EndArterectomy (CEA) and Carotid Artery Stenting (CAS) and their eventual impact on clinical management.
Methods and Materials: Between 2010 and 2011 two groups of 30 patients referred for CAS or CEA were prospectively enrolled. Pre-procedural imaging was performed with ECD and CTA. ECD was repeated within 24 hours, at one, six and twelve months from the procedures. PSV and EDV were assessed at 2 standard site: CCA and distal ICA.
Results: Twenty-four hours findings highly differs between populations.CCA PSV in the CEA and CAS group were respectively 44.88±9.16 cm/sec and 69.20±20.04 cm/sec (p= 0.002);CCA EDV were 16.11±2.29 cm/sec and 19.13±6.42 cm/sec (p=0.065);ICA PSV were 46.11±7.9 cm/sec and 94.02±57.7 cm/sec (p=0.0012);ICA EDV were 20.22±4.33 cm/sec and 30.47±18.33 cm/sec (p= 0.025).One month, six months and one year follow-up confirmed the different trend in the findings of two cohorts; in particular at one year:CCA PSV were 50.94±12.44 cm/sec and 60.59±26.84 cm/sec (p=

Friday

0.181);CCA EDV were 17.11±3.46 cm/sec and 19±16.35 cm/sec (p=0.634);ICA PSV were 51.66 ± 10.1 cm/sec and 70.86 ± 20.64 cm/sec (p=0.014);ICA EDV were 25.05±8.65 cm/sec and 32.66±13 cm/sec (p= 0.0609).
Conclusion: ECD follow-up is mandatory for these patients, allows to reduce false positive re-stenosis diagnosis, to choose the best anti-aggregation therapies. Within the first month from CEA patient benefits of a lower risk condition compared to CAS patient, due to a significant faster drop of the PSV; moreover long-term CEA CCA PSV could be used as a surrogate marker of neointima formation.

B-0504 14:36

Paclitaxel-coated balloon-angioplasty for central-venous re-stenosis in patients with haemodialysis fistulas

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Purpose: Retrospective evaluation of standard (POBA) and Paclitaxel-coated balloon angioplasty (PCBA) for central venous re-stenoses in patients with impaired haemodialysis fistulas.
Methods and Materials: 27 patients (male 15, female 12, mean 66±14 [39-90] years) with 32 non-malignant central venous stenoses confirmed by sonography, MRI or venography were treated initially by POBA. In case of symptomatic re-stenoses re-intervention was done by POBA in 5 patients of whom 2 patients underwent 11 or 5 POBA treatments. PCBA was performed in 13 patients after single or repetitive POBA. All Paclitaxel-coated balloons (Elutax SV, AachenResonance, Germany) (diameter 6-14 mm) were custom-made.
Results: Central venous stenosis included the axillary (11), subclavian (6), brachiocephalic (12) and/or superior caval vein (3). 3 patients had a combination of 2, 1 patient of 3 central venous stenoses. Overall primary technical (residual stenosis < 30%) and clinical (shunt function) success of initial and re-angioplasty was 100%. Re-interventions (POBA n=32; PCBA n=20) due to re-stenosis were necessary in 15 (55.6%) patients. Kaplan-Meier analysis revealed PCBA significantly superior to POBA. Median freedom from TLR after PCBA was 12 months vs. 5 months after POBA (p=0.03; Log-rank (Mantel-Cox), Gehan-Breslow-Wilcoxon test). Re-re-stenosis intervals were significantly prolonged by PCBA (mean 9.5±1.9 months) vs. POBA (mean 5±4.9 months) (p=0.01; unpaired t-test). No minor/major procedure-associated complications occurred.
Conclusion: Paclitaxel-coated balloon-angioplasty of central-venous re-stenosis yields a significantly longer freedom from TLR in patients with haemodialysis shunts and therefore should be the primary treatment approach.

B-0505 14:45

Paclitaxel-coated balloons vs. plain balloon angioplasty for the failing fistula: final 1-year results of the randomised controlled trial

P.M. Kitrou[1], S. Spiliopoulos[1], K. Katsanos[2], M. Kyriakopoulou[1], D. Karnabatidis[1], D. Siablis[1]; [1]*Patras/GR*, [2]*London/UK (panoskitrou@gmail.com)*

Purpose: To report the final 1-year results of a prospective randomised controlled trial investigating paclitaxel-coated balloon (PCB) vs. plain balloon (PB) angioplasty for the treatment of failing arterio-venous fistulae (AVF).
Methods and Materials: From May 2011 to September 2012, 40 patients were randomised to undergo either PCB dilation (Group PCB, *n*=20) or PBA (Group PB, *n*=20). Enrollment criteria included a clinical and angiographic diagnosis of dysfunctional AVF circuit due to at least one stenotic lesion. Regular angiographic follow-up was scheduled every 2 months. Study primary endpoints included technical success (defined as residual stenosis of the treated lesion < 30% without any significant dissection) and primary patency of the treated site (defined as angiographic visualisation of a patent lesion with < 50% restenosis and no need for any additional repeat procedure within the previously treated lesion due to failing access).
Results: Baseline variables were equally distributed among the two groups. Technical success was 100% for both the groups. Interim calculation of the primary endpoint outcome showed a significantly superior primary patency in group PCB compared to group PB at 6 months (65.0% vs. 30%, respectively; *p*=0.04).
Conclusion: Six-month interim results show that PCB angioplasty could be a valid solution in to our armamentarium for the treatment of failing AVF. Long-term 1-year final data will be announced.

B-0506 14:54

Single center prospective randomised study to evaluate treatment of superficial femoral artery chronic in-stent occlusion with combined laser atherectomy and drug eluting balloon angioplasty in patients with critical limb ischemia

C. Del Giudice, R. Gandini, S. Merolla, D. Morosetti, E. Pampana, G. Simonetti; *Rome/IT (costantino.delgiudice@gmail.com)*

Purpose: To compare efficacy and safety of laser debulking (LD) and drug eluting balloon (DEB) angioplasty to treatment with DEB angioplasty alone in patients affected by critical limb ischemia (CLI) and superficial femoral artery (SFA) chronic stent occlusion.
Methods and Materials: From December 2009 to March 2011, 48 patients (of 448 CLI patients)underwent endovascular treatment of a SFA chronic stent occlusion. The patients were randomly subdivided in two groups: LD combined with DEB angioplasty was used in 24 patients (Group 1) and 24 patients were treated with DEB angioplasty alone (Group 2). The patency rate at 12 months follow-up was the primary endpoint. Secondary endpoints were target lesion revascularisation (TLR) and clinical success at 12 months follow-up.
Results: In Group 1, the patency rate was significantly higher than in Group 2 at 6 and 12 months follow-up (respectively 91.7% and 66.7% in group 1 and 58.3% and 37.5% in group 2, p=0.01). TLR at 12 months follow-up was 16.7% in group 1 and 50% in group 2 (p=0.01). Two patients (8.3%) needed major amputations in group 1 while 11 patients (45.8%) in group 2 at 12 months follow-up (p=0.003).
Conclusion: The combined treatment with LD and DEB angioplasty is correlated with better outcomes in CLI patients with SFA stent occlusions.

B-0507 15:03

Evaluation of local thrombolysis for thrombosis of total implantable venous access devices (port-systems)

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Purpose: Evaluation of local thrombolysis for thrombosis of total implantable venous access devices (venous port-systems).
Methods and Materials: 101 patients (15-81 years) with port-dysfunction were referred for angiography. Thrombosis of the port-catheter was treated by local thrombolysis with injection of 3-5 mg rt-PA directly into the port system. Port function was re-evaluated by re-angiography the next working day.
Results: Port-dysfunction was obvious due to impossible blood aspiration in 59 ports. Injection of saline solution was impossible or only with unusual high pressure achievable in 41 ports. 3 patients reported local pain during injection. Angiography depicted port-catheter thrombosis in 46 ports. 41 patients agreed to a local thrombolysis treatment. Re-angiography on the next working day (time interval 16 hours-3 days) confirmed a successful procedure in 37 (90%) patients. 5 ports showed residual thrombosis but working port-function. Re-thrombosis occurred in 3 patients after 5 days (n=1) and 3 months (n=2). Unsuccessful thrombolysis was observed in 4 patients with extensive thrombosis extending into the subclavian and jugular veins. Complete dislocation or disruption with consecutive malfunction of the TIVAD was detected in 15 (15%) patients. 4 TIVAD-catheters dislocated into the vena cava or right heart and were successfully retrieved. 17 mal-functioning ports showed misplaced catheter-tips. 16 were corrected interventionally yielding complete restored port function. No patient was referred for a second repositioning.
Conclusion: Port-catheter thrombosis related dysfunction can easily and safely treated by local thrombolysis.

B-0508 15:12

Incidence and management of visceral artery aneurysms (VAA)

M.B. Pitton, E. Dappa, R. Kloeckner, S. Schotten, G.M. Wirth, A. Lollert, F. Jungmann, J. Doering, C. Dueber; *Mainz/DE (Michael.Pitton@unimedizin-mainz.de)*

Purpose: Visceral artery aneurysms (VAA) are rare but imply an risk for acute rupture. We analysed the institutional data base for diagnosis and management of VAA over a period of 10 years.
Methods and Materials: 239 patients were identified suffering from VAA. VAA were analysed with respect to location, size, true aneurysm or false aneurysms after surgery/intervention, rupture status, management, and clinical follow-up.
Results: VAA were located in splenic artery (n=81), celiac trunk (n=46), renal artery (n=42), hepatic artery (n=37), superior mesenteric artery (n=15), gastroduodenal artery (n=10) and others (8). Mean follow-up was 42.9±34.9 months. 181 of 239 patients were monitored conservatively. 58 cases were treated with transarterial intervention (n=47, embolisation, stentgrafting, or combinations) or surgery (n=11), 40 patients were diagnosed at rupture and were treated on an emergency basis. There was no significant difference in size between ruptured and non-ruptured VAA (15.2 ± 8.4 mm vs. 16.3 ± 10.1 mm). The 30-day mortality in ruptured cases was 8.3% after

interventional treatment compared to 0% in elective cases. Conservatively treated patients presented a 30-day mortality of 6.1%.
Conclusion: The clinical impact of VAA remains unclear. There was no difference in size in ruptured and non-ruptured aneurysms. Interventional treatment seems to offer a beneficial approach compared to surgery.

B-0509 15:21

Single-center experience in endovascular treatment of visceral artery aneurysms and pseudoaneurysms with Viabahn covered stent: technical aspects, success rate, complications and MDCT follow-up

M. Orsi, M. Venturini, F. Morelli, M. Colombo, C. Sallemi, F. De Cobelli, M. Salvioni, S. Cappio, A. Del Maschio; *Milan/IT (orsi.marcello@hsr.it)*

Purpose: To report our single-center experience in endovascular treatment of visceral artery aneurysms/pseudoaneurysms with Viabahn covered stent.
Methods and Materials: From 2005 to 2013, 13 patients were treated with 16 self-expandable covered stents (Viabahn, Gore; diameter from 5 to 8 mm; length from 2.5 to 5 cm): 11 in the hepatic artery, 4 in the splenic artery, 1 in the renal artery. 6/13 patients were treated for aneurysms (3 splenic, 2 hepatic, 1 renal); 7/13 for post-surgical bleeding pseudoaneurysms (5 of the gastroduodenal artery, 1 of hepatic artery, 1 of the splenic artery). A transfemoral approach was performed in 11/13, left-transaxillary in 2/13 due to the unfavourable angle of the celiac trunk. Double antiplatelet therapy was administered for 6 months after stent placement. A triphasic contrast-enhanced MDCT was performed before, 1 day and 6 months after the procedure.
Results: All covered stents were properly placed in their targeted vessels. Successful treatment without complications was achieved in 10/13 patients. In 3/13 patients, complications were recorded: 1 post-stenting stenosis of the proper hepatic artery, resolved with PTA; 1 stent occlusion in the common hepatic artery, without liver ischaemia because of the blood supply from the gastroduodenal artery; 1 minimal splenic infarction after stent placement in the splenic artery without clinical consequences. At 6 months, MDCT showed stent patency in 12/13 cases.
Conclusion: Endovascular treatment of visceral aneurysms/pseudoaneurysms using a very flexible, self-expandable, Viabahn covered stent represents an effective, less invasive, more conservative alternative to surgery/embolisation.

14:00 - 15:30 **Board Room A**

Cardiac

SS 603b

Congenital heart disease and cardiac masses

Moderators:
J. Glowacki; Zabrze/PL
M. Kantarci; Erzurum/TR

B-0510 14:00

Right ventricular myocardial fibrosis detection using cardiac MR in repaired tetralogy of fallot: correlation between functional and clinical markers

N. Galea, V. Noce, V. Sorrentino, M. Francone, C. Catalano, I. Carbone; *Rome/IT (vinc.noce@hotmail.it)*

Purpose: To assess correlations between right ventricular myocardial fibrosis, detected by late gadolinium enhancement (LE) on cardiac magnetic resonance (CMR), bi-ventricular function and clinical data after surgical correction of tetralogy of fallot (rToF).
Methods and Materials: Study population included a retrospective selection of 15 patients with rToF undergone to a complete CMR assessment including: cineMR steady-state free precession (SSFP) sequences to assess bi-ventricular volumes, myocardial mass and peak filling/ejection rates, T2 STIR sequences and T1-weighted inversion-recovery images after 0.1 mmol/kg Gd-BOPTA injection to detect right ventricular late enhancement (RVLE). A clinical dataset at the time of CMR scan was built up for each patient, including NYHA class, exercise tolerance, history of arrhythmias and syncope.
Results: 9/15 patients presented RVLE, localised at RV insertions points (7/9) and amongst RV trabeculations (2/9). On the basis of RVLE finding, we divided our cohort into positive and negative groups for statistical analysis (difference between means assessed with student's t test independent sample, correlation assessed with Spearman/Pearson analyses). We determined that RVLE presence correlates with reduction of RV ejection fraction (47.2±5.6%, $p < 0.001$) and end-systolic volume index increases (57.3±7.2 ml/m2, $p < 0.001$). Moreover, a negative correlation was found between RVLE presence and both NYHA class and exercise tolerance (mean exercise duration 778±47 min, $p < 0.001$).
Conclusion: Our study exposed a high prevalence of RVLE in rToF patients, determined by LGE CMR. RVLE presence was correlated to RV functional decline and clinical deterioration. No correlation between RVLE and left ventricular function parameters was showed.

B-0511 14:09

Diagnostic value of dual source CT angiography in congenital heart diseases: comparison with transthoracic echocardiography and angiography

M.A. Karimi, F. Sedaghat, M. Motevalli, H. Pouraliakbar; *Tehran/IR (mkarimidr@yahoo.com)*

Purpose: Dual-source CT angiography (DSCTA) is a new imaging method with high spatial and temporal resolutions that provides valuable information about detailed structures of heart. The aim of this study was to determine diagnostic value of DSCTA in cardiac diseases.
Methods and Materials: Parameters of diagnostic value (sensitivity, specificity, positive predictive value [PPV], negative predictive value [NPV] and diagnostic accuracy) of DSCTA were determined in 36 patients with congenital heart diseases (median:8.5 month [neonate to 35 y]; 21 male) who underwent surgery in Shahid Rajaei Hospital from September 2010 to March 2011, and compared with that of angiography and transthoracic echocardiography (TTE). Surgery was gold standard.
Results: Total 105 cardiac anomalies were diagnosed. Sensitivity, specificity, PPV, NPV and accuracy of DSCTA were 98.25%, 97.9%, 98.1%, 99.07%, and 98.2%, respectively. These values were 95.04%, 98.7%, 97.8%, 98.1%, and 98%, respectively, for angiography, and 93.5%, 96.2%, 94.4%, 96.3%, and 95.4%, respectively, for TTE. There was no statistically significant difference between three methods. Only, one ASD and 2 PDA were missed in DSCTA. Angiography missed 2 ASD and 2 PDA, and TTE missed 7 ASD, one VSD, and 3 PDA. DSCTA also provided important findings (n=38) about intrathoracic or abdominal organs.
Conclusion: DSCTA has a diagnostic value similar to angiography for congenital heart diseases and can obviate the need for invasive diagnostic modalities. DSCTA also can provide important information about detailed anatomic structures of heart, vessels, lungs and intra-abdominal organs.

B-0512 14:18

The relationship of location of patent foramen ovale with severity of stroke: a life-saving radiological approach

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Purpose: Patent foramen ovale (PFO), is a common developmental anomaly that causes paradoxical embolus and may be found in approximately 25% of adults. In literature, PFO and stroke is well associated as PFO causes for up to 40% of all ischaemic strokes. However, percutaneous closure of PFO for the patients with/without stroke is controversial. The aim of this study is to investigate the relationship of the location of PFO with severity of stroke and to help identify the patients who would benefit from percutaneous PFO closure before ischaemic stroke appears; which is vital.
Methods and Materials: 17 patients with stroke and echocardiographically proven PFO were classified according to the severity of stroke by cranial MRI; and the locations of PFO were determined as superior and inferior based on an imaginary line that separates the interatrial septum into two equal parts by cardiac CT. Paired statistical analysis was applied.
Results: 4 patients (47%) revealed mild, 5 patients (30%) severe and 8 patients (23%) moderate according to their severity of stroke. Based on the PFO locations, there were 13 (77%) patients with superiorly (group I), and 4 patients (23%) with inferiorly located PFO (group II). Statistically, there was a strong correlation between the patients presenting with moderate and severe stroke with group.i. ($p < 0.005$).
Conclusion: Superiorly located PFO patients have a greater risk for stroke and may face different neurological problems in their rest of life, percutaneous closure of superiorly located PFOs when detected will provide a life-saving process.

B-0513 14:27

Two methods for quantification of cardiovascular shunts by cardiac magnetic resonance (CMR) in patients with atrial septum defects (ASD)

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Purpose: To compare velocity-encoded phase-contrast (VENC) MRI and volumetric analysis of shot-axis images for quantification of cardiovascular shunts in patients with atrial septum defect (ASD).
Methods and Materials: 31 patients (16/15-f/m, mean age 36, 7±16, 7 years) with ASD underwent 1, 5 CMR to determine the size and localisation defects, to quantify shunts between systemic (Qs) and pulmonary (Qp) circulation. 25

patients had ostium secundum defects (11 of them - small multiple defects), 5 sinus venosus and 1 ostium primum defect. A typical CMR protocol included long- and short-axis cine steady-state free-precession images and VENC images. VENC images acquired perpendicular to the ascending aorta and main pulmonary artery for measuring Qs and Qp. Using volumetric analysis, shunt volume and shunt fraction were calculated as the difference between left ventricle and right ventricle stroke volumes (SV). Semiautomatic postprocessing was used for calculating Qp:Qs with both methods.
Results: The ratio Qp:Qs ranged from 1:1.1 to 1:4 (mean 2.1±0.96). Patients with Qs:Qp> 1.5 were recommended for cardiac surgery consultation. Correlation between Qp:Qs mesuared with VENC and SV difference was very strong (p=0.99). In small left-to-right shunts (Qp:Qs< 1, 3), the cardiac chambers were not significantly enlarged and the pulmonary vasculature was usually normal. In patients with large (Qp:Qs> 2.0), right atrial and right ventriculars volumes were increased and signs of pulmonary hypertension were found.
Conclusion: Volumetric analysis of short-axis images could be an alternative to VENC method for quantification of cardiovascular shunts in patients with ASD.

B-0514 14:36

Role of 256-MDCT in evaluation of image quality and radiation dose in prospective gating in congenital heart diseases in infants
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Purpose: To evaluate image quality and radiation dose in prospectively ECG gated 256 Slice MDCT angiography in infants with congenital heart diseases.
Methods and Materials: From May 2011 to May 2013, 60 infants with congenital heart disease referred for pre-operative or post-operative CT were included. All were scanned with 256 MDCT Somtom Definition Flash Siemens Dual source Unit utilising a low dose protocol.
Results: No serious reactions noted. A total 184 cardiac anomalies were confirmed by surgery or heart catheterisation.The sensitivity of MDCT for cardiac anomalies was 97.1%, specificity 98.4%, and accuracy 95.2%. The mean heart rate during scan was 126/min. Mean scan length was 115.3 mm. Mean volume CT dose was 2.1mGY. Diagnostic quality images were obtained and viewed by two radiologists independently.
Conclusion: Low dose prospectively gated CT in infants with CHD is the ideal modality with comprehensive 3D evaluation including coronary arteries with minimal mean volume CT dose.

B-0515 14:45

Delayed myocardial enhancement in pediatric idiopathic hypertrophic cardiomyopathy
N.H. Behairy, W. El Mozy; *Cairo/EG (nohabehairy@gmail.com)*

Purpose: To detect the presence of myocardial fibrosis in paediatric age group and whether there is a certain age of which fibrosis may be suspected.
Methods and Materials: We prospectively studied 20 patients diagnosed as idiopathic hypertrophic cardiomyopathy clinically and by echocardiography as well as laboratory methods. Patients were between 1.5 yrs up to 16 years. All patients were subjected to MRI and echocardiography. MRI was performed on (ACHIEVA, 1.5 T Philips Medical Systems,Netherlands). Balanced FFE in 2, 4 chambers as well as short axis images were taken in 20 cardiac phases along with delayed enhancement after 5-10 min with triple inversion recovery after performing look locker to determine the best time of delay. Q flow was done to detect the presence of obstruction at the aortic valve region. Images were analysed for volumetric measurements, functional analysis and myocardial tissue characterisation. The presence, pattern and site of ventricular enhancement were studied.
Results: Fifteen patients (75%) showed presence of patchy midwall myocardial enhancement. 25% of patients did not show any enhancement. Some of the patients with evident myocardial enhancement were as small as 1.5 years. Myocardial thickness ranged from 15 to 24 mm. Enhancement was present in the area of most hypertrophy. Ejection fraction ranged from 55 to 72%.
Conclusion: Myocardial fibrosis may be present in paediatric hypertrophic cardiomyopathy with no cut-off value for age.

B-0516 14:54

Detection and characterisation of myocardial fatty foci in patients affected by tuberous sclerosis complex using high-resolution computed tomography: a new diagnostic criteria?
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Purpose: To evaluate prevalence and characteristics of MFF in TSC patients undergoing HRCT.
Methods and Materials: All consecutive TSC patients who underwent 64-slice HRCT (1.25x1.25 mm) for suspected lymphangioleiomyomatosis (LAM) between January 2010 and August 2013 were retrospectively selected. Image evaluation was performed (in double blind trial) by two radiologists with different experience in cardiac imaging using both axial and multiplanar reformation (MPR) images even on cardiac axis (short axis, long axis and 4-chamber view) to detect MFF (well-circumscribed areas with homogeneous fat CT density within the myocardium). MFF presence, number, site, size and shape were evaluated. In doubtful cases (e.g. artefacts due to hearth pulsation), the patient was considered free of foci. Information about other organs involvement (brain; kidneys; liver; lung) were obtained. Descriptive statistics were used and correlation between MFF and other organs' involvement was estimated.
Results: Study population resulted composed of 39 patients (35 females; mean age 34.5 years; range 18-52 years). MFF were identified in 51.3% (20/39) of patients 7 of whom (35%) had TSC multiorgan involvement. MFF were more often linear and identified more frequently in the apical interventricular septum; MFF size range was 8-50 mm. Other organ involvement was as follows: kidneys 84.6% (33/36) of patients; lung 79.4% (31/39); brain 66.6% (26/39), liver 46.1% (18/39). Only 2 patients with multiorgan involvement had no MFF.
Conclusion: Prevalence of MFF in TSC patients is high and it is often associated to other organ involvement

B-0517 15:03

Isolated left ventricular non-compaction: relationship between MRI criteria for non-compaction and clinical events
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Purpose: Isolated ventricular non-compaction (LVNC) is characterised by a compacted epicardial band and a non-compacted endocardial layer. Complications are ventricular dysfunction, arrhythmias and thromboembolic events. The aim of the study was to look for a potential relationship between MRI's non-compaction extension criteria and clinical events.
Methods and Materials: Between 2004 and 2013, 99 patients were included in a retrospective study reviewing MRI with LVNC. MRI diagnosis criteria for LVNC was the ratio of the thickness of non-compacted (NC) to compacted myocardial layers superior to 2.3, in the diastolic phase. LV ejection fraction, volumes, global LV mass, compacted and NC LV mass, number of NC segments and non-compaction score (NCS) were measured. A LV remodelling index (LVRI) defined as the ratio between LV compacted mass and LV end-diastolic volume was calculated.
Results: There were no statistical relationships between LVEF alteration and NCS (p=0.57) and the number of NC segments (p =0.97), between stroke incidence and NCS (p=0.22) and the number of NC segments (p=0.96) and between ventricular arrhythmias and NCS (p=0.59) and the number of NC segments (p=0.59). There was a significant inverse relation between LVEF and compacted mass (p < 0.0001) and between stroke and compacted mass (p = 0.007), but not for ventricular arrhythmias (p = 0.95). There was no statistical relationship between LVRI and LVEF, arrhythmias or stroke.
Conclusion: This study did not show any association between MRI NC extension criteria and clinical events, but showed a relationship between compacted mass and LVEF dysfunction and stroke incidence.

B-0518 15:12

Differences in CMR characteristics between pulmonary hypertension associated to congenital heart disease and other precapillary pulmonary arterial hypertension subgroups
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Purpose: To compare CMR parameters between patients with pulmonary arterial hypertension associated to congenital heart disease (CHD-PAH) with those of patients classified in the rest of precapillary pulmonary arterial hypertension subgroups (pPAH).
Methods and Materials: All patients underwent cardiac magnetic resonance (CMR),(Siemens Avanto 1.5T) for the determination of right ventricular (RV) function and pressure overload and echocardiographic study for the assessment of tricuspid annular plane systolic excursion (TAPSE) on the same day.
Results: Our study included 6 patients with CHD-PAH (mean age 40.3±13.9years) and 8 with pPAH (mean age 51.4±11.5years). Patients in both study groups retained mildly reduced but similar RV function, as expressed by TAPSE (1.7±0.2 cm in CHD-PAH and 1.8±0.3 cm in pPAH, p> 0.05) and RV ejection fraction (46.8±10.9% in CHD-PAH and 48.2±11.6% in pPAH, p> 0.05), although CHD-PAH patients had higher RV diastolic pressure overload (as expressed through RV eccentricity index in diastole: 2.3±0.3 and 1.7±0.2 respectively, p=0.002). Pulmonary artery (PA) was more severely dilated in CHD-PAH than in pPAH [as expressed by PA diameter in systole (5.1±0.5 cm

and 4.2±0.5 cm, p=0.01) and in diastole (4.9±0.5 cm and 4.0±0.5 cm, p=0.009)].
Conclusion: Although patients with CHD-PAH have more severely pressure overloaded right ventricle, they manage to retain similar RV function when compared to pPAH patients. This may reflect the progressive RV adaptation to chronic increase of RV blood flow and pressure occurring before the development of elevated pulmonary vascular resistance and fixed PAH. PA dilatation is another compensatory mechanism in CHD-PAH patients and may explain their greater risk of in situ thrombosis.

B-0519 15:21

Intracardiac thrombus and masses in patients with CAD: CMR versus TTE

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Purpose: Transthoracic echocardiography (TTE) is widely used for patients with coronary artery disease (CAD) and suspected intracardiac mass. This study aimed to assess the current role of cardiac MRI (CMR) to differentiate cardiac masses from thrombus formation in comparison to TTE.

Methods and Materials: 171 patients (89 male, aged 34-89 years, median 60.8±10.7) with known CAD who had been referred to TTE for evaluation of known or suspected intracardiac mass, underwent additional 1.5-Tesla CMR. TTE and CMR were independently evaluated for thrombus formation or intracardiac mass and related size, shape, signal characteristics and morphology.
Results: TTE depicted intracavitary thrombus formation in 40/171 patients (23.4%) and intracardiac mass in 12/171 patients (7.0%). All masses detected in TTE were correctly seen on CMR. However, CMR showed 15 subsequent thrombi and 3 additional intracardiac masses (p= 0.001) that were not detected in TTE. Patients with impaired systolic function (LVEF< 30%) showed misleading results when referred to TTE (19 vs. 27 masses detected, $p < 0.01$).
Conclusion: TTE depicted intracavitary thrombus formation in 40/171 patients (23.4%) and intracardiac mass in 12/171 patients (7.0%). All masses detected in TTE were correctly seen on CMR. However, CMR showed 15 subsequent thrombi and 3 additional intracardiac masses (p= 0.001) that were not detected in TTE. Patients with impaired systolic function (LVEF< 30%) showed misleading results when referred to TTE (19 vs. 27 masses detected, $p < 0.01$).

B-0520 15:30

The application of dual source CT in complex congenital heart disease of tetralogy of Fallot

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Purpose: To investigate the clinical value and accuracy of DSCT in the assessment of patients with Tetralogy of Fallot (TOF).
Methods and Materials: 70 patients suspected or known complex congenital heart disease of tetralogy of Fallot underwent DSCT. A combination of restruction with images of end-systole, including maximum intensify projection, multi-planar reconstruction, volume rendering, and so on. Seek the cardiovascular malformation according to the Van Praagh Segment analytical method. Two radiologists with 5 years experience in the field of cardiovascular imaging diagnosis assessed the imaging. The DSCT imaging diagnosis was compared with echocardiography (ECHO) or operation results. Analyse the accuracy of DSCT and the ECHO results compared with surgery. Descriptive statistics was used to compare efficacy.
Results: 51 patients had surgery in all 70 patients. 255 places of malformation were proved by operation, including 91 intracardiac malformations and 164 extracardiac malformation. The diagnostic accuracy of intracardiac malformations were 94.5% (86/91) and 97.8%(88/91) respectively by DSCT and ECHO. There were no significant differences between DSCT and echocardiography ($\chi2=1.051$,$P> 0.05$). The diagnostic accuracy of extracardiac malformations were 97.8% (160/164) and 71.95% (118/164) respectively by DSCT and ECHO. There were significant differences between DSCT and echocardiography ($\chi2=40.649$, $P < 0.01$). For all the 255 places of cardiovascular malformation, the diagnostic accuracy of DSCT, echocardiography were 96.47% and 81.17%, respectively. There were significant differences between DSCT or echocardiography for assessment of cardiovascular malformation ($P < 0.01$).
Conclusion: DSCT is superior to echocardiography for quantitative assessment of extracardiac malformations in patients with complicate congenital heart disease of TOF, which is significant for clinical surgery.

14:00 - 15:30 **Room P**

Molecular Imaging

SS 606
Translational studies

Moderators:
C.C. Cyran; Munich/DE
J. Grimm; New York, NY/US

B-0521 14:00

Detection of early precursor lesions of pancreatic cancer using hyperpolarised [1-13C]pyruvate

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Purpose: Pancreatic ductal adenocarcinoma (PDA) is the fourth leading cause of cancer-related deaths worldwide. Improvements in mortality may only be possible by early diagnosis of pancreatic precursor lesions (i.e. PanIN), however this is still challenging clinically due to the lack of sensitive and specific biomarkers. The aim of this study was to identify metabolic signatures associated with the different stages of PDA progression using 13C magnetic resonance spectroscopic imaging of hyperpolarised [1-13C]pyruvate in a genetically engineered mouse model of pancreatic cancer.
Methods and Materials: LSL-KrasG12D/+-p48Cre/+(KC) mice with mPanIN, LSL-KrasG12/D+;LSL-Tpr53R172H/+;Pdx-1-Cre (KPC) mice with spontaneous pancreatic cancer and control mice were used. KPC and C57BL/6 mice were used as models of established tumour and normal tissue, respectively. MRI was performed at 7T using a 13C/1H volume coil/20-mm diameter 13C-surface coil combination. A chemical shift image was acquired from a single 4-8 mm axial slice covering the pancreas 20 sec after injection of 0.3 mL (82 mM) hyperpolarised [1-13C]pyruvate. [1-13C]Pyruvate, [1-13C]lactate (lac) and [1-13C]alanine (ala) signal intensities in the pancreas were analysed. 1H-NMR spectra of tissue extracts were obtained at 14.1T (TR 12.5s) and Lac and Ala concentrations calculated. Tissues were evaluated histologically.
Results: Progressive reduction of [1-13C]Ala/[1-13C]Lac ratio was observed with increasing disease progression. No changes were observed in control mice.1H-NMR spectra of tissue extracts revealed the same Ala/Lac signature.
Conclusion: [1-13C]Pyruvate metabolism and the ratio of the subsequently formed [1-13C]Ala and [1-13C]Lac may form useful probes for detecting and following progression of panIN lesions, before any mass-forming lesion (tumour) can be detected by conventional imaging. This may offer an improved diagnostic tool in high-risk populations.
Author Disclosures:
E.C.P.M. Serrao: Research/Grant Support; General Electrics. **M.I. Kettunen:** Research/Grant Support; General Electrics. **T.B. Rodrigues:** Research/Grant Support; General Electrics. **P. Dzien:** Research/Grant Support; General Electrics. **F.A. Gallagher:** Research/Grant Support; General Electrics. **D. Tuveson:** None. **K.M. Brindle:** Research/Grant Support; General Electrics.

B-0522 14:09

Evaluation of anti-angiogenic therapies using molecular MRI and DCE-US in kidney tumour xenograft

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Purpose: To study the interest of molecular MRI-targeted αvβ3 compared to DCE-US and to evaluate several anti-angiogenic drugs in xenografted kidney cancer.
Methods and Materials: 24 mice were xenografted (3.106 cells A498). We performed imaging evaluations in 4 groups, 1 control and 3 treated with antiangiogenic drugs: monoclonal anti-body (bevacizumab), thyrosine kinase inhibitor (sunitinib) and m-Tor inhibitor (everolimus). MR acquisitions were performed on a 1.5 T Achieva system (Philips), using a conventional surface coil. Susceptibility MRI was done after injection of an USPIO-RGD-based nanoemulsion binding αvβ3 (P04000 Guerbet). DCE-US was performed with Toshiba Aplio XV using high-frequency probe and microbubbles (Sonovue, Bracco). Molecular MRI and DCE-US were performed at the same days: baseline and D3. We evaluated R2* in the tumour 1 hour after P04000 with MRI and blood volume using AUC for DCE-US.

Results: Tumor size wassignificantly different between control and treated groups at D3 (p=0.0099). AUC calculated with DCE-US at D3 was significantly lowest for bevacizumab group (p=0.008) and not significant for the two other treatments. R2* quantification at D3, 1 hour after P04000 injection, is reduced from 23.1±4.6 s-1 in the control group to 7.9±4.8 s-1 ($p < 0.007$) for everolimus 13.5±7.9 s-1 ($p < 0.047$) for bevacizumab and not significant for sunitinib.
Conclusion: Molecular imaging with αvβ3-targeting contrast agent is complementary or even more sensitive than blood volume determination by DCE US to detect effects of antiangiogenic drugs with different mechanism of action.
Author Disclosures:
X. Violas: Employee; Guerbet. **P. Robert:** Employee; Guerbet.

B-0523 14:18

Optimisation of combination of peptide receptor radionuclide therapy (PRRT) and temozolomide therapy using SPECT/CT and MRI in mice

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Aim:
Treatment of patients with somatostatin receptor (SSTR)-overexpressing neuroendocrine tumours (NET) with the SST-analogue Lutetium-177-labelled octreotate (PRRT) or the chemotherapeutic agent temozolomide (TMZ) is successfully being applied. Their combination might result in additive effects. Using MRI and SPECT/CT we studied tumour characteristics and therapeutic responses after different administration schemes in a murine tumour model in order to identify the optimal treatment schedule for PRRT plus TMZ.
Methods and Materials:
We performed molecular imaging studies in mice bearing SSTR-expressing H69 tumours after single i.v. administration of 30 MBq ^{177}Lu-octreotate or TMZ (oral 50 mg/kg daily for 14d). Weekly tumour perfusion was evaluated by DCE-MRI, whereas tumour uptake of ^{111}In-octreotide was quantified using SPECT/CT until d40. Based on these results, seven different ^{177}Lu-octreotate and TMZ treatment schemes were evaluated, varying the order and time interval of the two therapies besides single treatment.
Results:
PRRT or TMZ resulted in reduced tumour size, accompanied by significant changes in MRI characteristics such as intrinsic T2, T2* values and enhanced tumour perfusion. Moreover, TMZ treatment also resulted in increasing uptake of ^{111}In-octreotide until d15. In the subsequent therapy study 90% of animals receiving PRRT at d15 after TMZ treatment showed complete response; indeed the best anti-tumour results compared to single and other combination therapies.
Conclusions
Molecular imaging studies indicated that PRRT after TMZ treatment could achieve optimal therapeutic effect because of enhanced tumour uptake of radioactivity, which was confirmed in the therapy study. Therefore TMZ administration prior to PRRT might increase tumour responses in NET patients as well.

B-0524 14:27

A multimodal quantitative molecular imaging protocol for kidney tumor mouse model characterisation using targeted contrast agents

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Purpose: Comparison of two molecular imaging techniques (US and MRI) using targeted αvβ3 contrast agents in a xenograft tumor model.
Methods and Materials: Dynamic contrast-enhanced DCE-US and dynamic susceptibility contrast DSC-MRI with αvβ3-targeted contrast-agents (CA) were applied. Mice were xenografted with a human kidney tumor: cells (3.106 cells A498) were injected subcutaneously to 13 nude mice. At day 20-22 after injection, mice were anesthetised (isoflurane+O2) and imaged. MR and US targeted and non-targeted CA were injected at 2 days intervals. Apparent Diffusion Coefficient (ADC) and DCS-MR acquisitions were done at 1.5 T (Philips Achieva, micro23 coil). DSC were done using a USPIO-based nanoemulsion targeted with RGD binding αvβ3, as well as a control nanoemulsion (Guerbet). Molecular US acquisitions were performed on a small animal dedicated system (Visualsonics VEVO-2100, 20 MHz probe MS-250), using MicroMarker™ αvβ3-targeted and control (IgG) µbubbles. Data were co-localised, ROIs were drawn for analysis of: tumor size, ADC, contrast enhancement and relaxivity R2* quantification.
Results: US and MRI tumor sizes correlated well, R=0.99 ($p < 0.001$ Pearson test). ADC values and US signal enhancement on hypo- and hyper-vascularised area correlated with R=0.73 (p=0.006 Pearson test). Targeted vs non-targeted injections gave significantly different 1) contrast modifications for DCE-US (p=0.0051, paired student's t-test) and 2) R2* modifications for DSC-MRI (p=0.0286, Mann-Whitney test).
Conclusion: Multimodal evaluation of targeted CA and various imaged-derived biomarkers for preclinical oncology may be used to follow-up treatment response. The use of clinical imaging set-up here could allow the fast transfer of this methodology into the clinics.

B-0525 14:36

MR imaging and targeting of a specific alveolar macrophage subpopulation in COPD animal model using antibody conjugated magnetic nanoparticles

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Purpose: MR Imaging of macrophages offers a promising noninvasive approach for better assessment of the pathophysiological impairments in COPD. Inside the body, different environmental conditions will orient macrophages to have either proinflammatory-M1 or immunomodulator-M2 profile. The purpose of this study was to characterise the in-vivo effect of magnetic nanoparticles (MNP) intrapulmonary administration on macrophages polarization in COPD and to specifically target and monitor one subpopulation using MRI.
Methods and Materials: COPD mice were exposed to PEGylated dextran-coated MNP. Surface membrane receptor expression, iNOS vs Arginase1 production and gene expression profile were performed to have an in-depth characterisation of macrophages polarization. CD86- or CD206-antibodies were then conjugated to maleimide MNP to specifically target and image either M1 or M2 macrophages using ultra-short echo time (UTE) sequence on a 4.7T magnet. The polarization profile of antibody-MNP targeted subpopulations was finally assessed using immunohistochemistry and flow cytometer.
Results: While a continuum balance in macrophages subpopulations was identified during COPD, MNP intrapulmonary administration did not affect their polarization profile. M1 and M2 macrophages were successfully targeted using CD86- and CD206-conjugated MNP respectively. MR imaging using UTE sequence allowed successful detection of hyper-intensity regions homogenously distributed in COPD lung using TE=1 ms and co-localisation of either CD86- or CD206-conjugated MNP targeted to macrophages subpopulations as hypo-intensity void signal due to macrophages aggregates using TE=0.4 ms.
Conclusion: Coupling of MNP with a specific antibody targeted to a particular macrophages subpopulation could offer a promising strategy for an early and better diagnosis of pulmonary inflammatory diseases using noninvasive MRI.

B-0526 14:45

Spatially resolved ex vivo quantification of a gadolinium-containing MR agent by matrix-assisted laser desorption ionization imaging: correlation to in vivo MRI

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Purpose: To evaluate MALDI imaging for spatially resolved ex vivo quantification of a gadolinium-based magnetic resonance agent in correlation to in vivo magnetic resonance imaging.
Methods and Materials: In vivo deposition of a Gadofluorine M was investigated in a mouse model of myocardial infarction. Mice were investigated by in vivo MRI at 7T at 6h, 24h and 48h after injection of 0.2 mmol/kg Gadofluorine M. Delayed enhancement was detected in the infarct scar using a conventional FLASH technique and quantified by calculating signal- and contrast-to-noise ratios. In addition, T1 mapping studies were performed using a snapshot technique. Animals were killed after each time point and hearts were prepared for quantitative assessment by MALDI imaging.
Results: Delayed enhancement imaging revealed signal enhancement in the myocardial scar beginning at 6h after Gadofluorine M injection with peak enhancement at 24h hours and residual enhancement at 48h post injection. Contrast-to-noise ratios were highest at 24h post injection due to high agent accumulation in the infarct and low signal from the blood. T1 values in the infarct were shortest at 6h and steadily increased to 24h and 48h post injection. MALDI Imaging was able to corroborate the in vivo imaging results and enabled in situ quantification of the in vivo applied Gadolfuorine M with high-spatial resolution.
Conclusion: MALDI Imaging is able to provide a mass-specrometry-based quantification of gadolinium-containing contrast agents in situ with high-spatial resolution. The results of MALDI Imaging correlate with in vivo MRI. For the first time, quantitative ex vivo validation of in vivo contrast agent distribution is possible.

B-0527 14:54

Optoacoustic imaging and staging of rheumatoid arthritis

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Purpose: The purpose of our study was to evaluate multispectral optoacoustic tomography (MSOT) in a murine model to visualise the extent of the inflammation in vivo through a L- and P-selectin targeting contrast agent.
Methods and Materials: Collagen-induced arthritis mice were used as a rheumatoid arthritis model of the limb. Optoacoustic imaging was performed using a L- and P-selectin targeting contrast agent (dPGS-NIR provided by Mivenion, Germany) to increase contrast of the arthritic joint, and signal intensity ratios between healthy and arthritic legs were calculated. Contrast-enhanced MRI imaging as well as clinical observation, lymphocyte and granulocyte count and histology served as references.
Results: MSOT using an inflammation targeting contrast agent allowed for accurate spatial diagnosis of inflammation in the mouse joints and for significant differentiation of inflamed to healthy joints (P = 0.023). The arthritis findings on the MSOT images were confirmed by clinical observation, blood analysis, contrast-enhanced MRI and ex vivo histology.
Conclusion: The combination of inflammation targeting contrast agent and optoacoustic tomographic imaging presents a reliable and accessible method to assess rheumatoid arthritis in respect to diagnosis and staging. Considering the current development of the imaging technology, it is to be expected that these approaches will be translated into clinical application as a fast and cheap way for imaging of rheumatoid arthritis.
Author Disclosures:
V. Ntziachristos: Shareholder; Ithera Medical GmbH.

B-0528 15:03

Au@Fe_3O_4 Janus particles as an innovative contrast agent for future multi-modal imaging

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Purpose: Based on their magnetic and optical properties, asymmetric Janus particles (JPs) display high versatility as multi-modal imaging tools or as drug target delivery systems. Due to poor data available on their impact on biological systems, we investigated newly developed Au@Fe_3O_4 JPs with varying position of amino groups on cells in culture.
Methods and Materials: JPs consist of gold at a silica-PEG-FITC coated iron oxide domain with thiole-groups attached to the gold part. We investigated biocompatibility via ATPLite, ROS, H2 A.X and comet assay and uptake by microscopy on endothelial cells and monocytes.
Results: Au@Fe_3O_4 JPs mainly exhibit a better biocompatibility up to 50 µg/ml Fe (II)/(III) (85.35% viability, 72 h) compared to their spherical counterparts. JPs with NH_2-functionalization decreased viability to 10.6%. Fe_3O_4 nanoparticles induced a high release of ROS compared to Au@Fe_3O_4 (189.23 % vs. 18.67%). 60%-70% of the JPs were internalised independently from the position of amino groups at the JP domains. JP associated DNA damage (10% higher vs. untreated cells) and a high amount of phosphorylated histone H2 A.X (fluorescence intensity (treated/untreated): 42996 vs. 31587) was independent from the effects on the cellular ATP levels (96% vs. control).
Conclusion: JPs offer a better biocompatibility compared to their spherical counterparts due to antioxidative effects of the gold domain. In the view of applications *in vivo,* Au@Fe_3O_4 particles would be preferred towards the Au@MnO variants because of their lower impact on cell metabolism. Combining good biocompatibility and the known imaging properties, JPs are very attractive for future biomedical applications.

B-0529 15:12

"To serve and protect" - enzyme inhibitors as radiopeptide escorts promote tumour targeting

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Purpose: Radiopeptide drugs like radiolabelled octreotide analogues are successfully being applied for tumour visualisation and treatment. However, translation of this paradigm to other radiopeptide ligands has been severely hampered by their often poor metabolic stability. We hypothesised a novel application - co-injection of a single enzyme inhibitor - to improve peptide bioavailability and hence tumour uptake in vivo. We co-injected radiopeptides and phosphoramidon (PA), a potent (IC_{50} 34 nM) and reversible competitive neutral endopeptidase (NEP)-inhibitor, to explore our hypothesis.
Methods and Materials: Co-injection of PA (0.3 mg) with ^{111}In-labeled somatostatin, gastrin and bombesin radiopeptides was tested in different mouse models (healthy mice as well as tumour-bearing SCID and nude mice). At 4 and 24 h post-injection, animal SPECT/CT imaging was performed followed by biodistribution measurements.
Results: We could provoke a remarkable and very significant rise (up to 40 times the control values) in the percentage of circulating intact ^{111}In-labelled somatostatin, gastrin and bombesin radiopeptides in healthy mice after PA co-injection. Most importantly, this strategy resulted in a spectacular increase of radiolabel accumulation (up to 14 times the control values) in different types of tumours xenografted in the mice. The improved tumour uptake could be clearly visualised by SPECT/CT as well.
Conclusion: Our findings open exciting new opportunities for the application of biodegradable peptide-drugs of either natural or synthetic origin as well as for the rationale design of in vivo stable analogues. They also provide a versatile tool for elucidating enzyme-peptide interactions.

B-0530 15:21

Camelid reporter gene imaging: a generic method for in vivo cell tracking of fluorescent/luminescent cells

L.R.Y. Goethals[1], G.-J. Allemeersch[1], T.J. Bos[2], J. de Mey[1], T. Lahoutte[1]; [1]*Jette/BE*, [2]*La Jolla, CA/US (Lode.Goethals@vub.ac.be)*

Purpose: To combine the sensitivity of bioluminescent imaging (BLI) with the 3D and quantitative properties of SPECT/micro-CT, we generated cell lines expressing a Yellow-Fluorescent-Protein and Gaussia Luciferase fusion protein (YFP/GLuc). For in vivo SPECT detection of this YFP/GLuc, a nanobody, binding yellow and green fluorescent proteins (anti-YFP-Nb), was labelled with 99mTc.
Methods and Materials: 10E5 HEK 293 T-cells were transduced with YFP/GLuc containing vector: both membrane-targeted (MT-YFP/GLuc) and non-targeted (YFP/GLuc) fusion proteins were developed. These were compared against a cell line expressing Green-Fluorescent-Firefly Luciferase (GFP/Fluc) and cells expressing Red Fluorescent Protein in combination with a Gaussia Luciferase (Red/GLuc). Transduction efficiencies were scored by fluorescence microscopy; cells were enriched by FACS. Luciferase functionality was tested in vitro by BLI. Subsequently, cells were transplanted subcutaneously in athymic mice (MT-YFP/GLuc: n=4, YFP/GLuc: n=6, GFP/Fluc: n=6, Red/GLuc: n=4). After transplantation, in vivo BLI was performed. Labelling efficiency of anti-YFP-Nb was measured using ITLC. One week after transplanation, 99mTc labelled anti-YFP-Nb was injected intravenously and SPECT/micro-CT was performed.
Results: Cells containing MT-YFP/GLuc were positive on fluorescent microscopy, with fluorescent signal confined to the cell membrane. Transduced cells were assayed by BLI and showed a significantly higher light output both in vitro and in vivo. Anti-YFP-Nb labelling efficiency was 98% and SPECT/Micro-CT demonstrated higher transplant to muscle ratio for both the MT-YFP/GLuc and YFP/GLuc groups, compared with the GFP/FLuc and Red/GLuc group.
Conclusion: This study provides a proof-of-principle for a nanobody-based cell tracking method, using a YFP/Gluc fusion protein and anti-YFP-Nb.

Saturday, March 8

10:30 - 12:00 **Room C**

Abdominal Viscera

SS 901a

Liver tumours: CT and MRI

Moderators:
D.M. Lambregts; Maastricht/NL
N.C. Tarhan; Ankara/TR

B-0531 10:30

Hepatocellular carcinoma (HCC) is more advanced at diagnosis in HIV-HCV (human immunodeficiency virus-hepatitis C virus) co-infected than in HCV mono-infected cirrhotic patients

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Purpose: To characterise the imaging of HCC in HIV-HCV co-infected cirrhotic patients compared to mono-infected HCV cirrhotic patients.
Methods and Materials: HCCs from a multi-centric cohort of 35 HIV-HCV cirrhotic patients (32 males, median age 50 years old [43-65], median CD4 count: 345 cells/mm^3 [24-1121], median duration from cirrhosis to HCC diagnosis: 4.5 years) and from a control group of 35 HCV cirrhotic patients (29 males, median age 56 years old [41-83]) were retrospectively included. CT or MRI image analysis was focused on the detection of nodular or infiltrative forms with evaluating the number and size of the nodules, evidence for vascular invasion and signs of portal hypertension. Fisher and Wilcoxon tests were used for statistical analysis.
Results: An infiltrative form was found in 8/35 HIV-HCV versus 0/35 in HCV patients (22.9% and 0%, respectively, p=0.002). Other HCCs were nodular in nature. A single nodule was found in 20/35 HIV-HCV (57%) and in 19/35 HCV patients (54%). The largest nodules had a median diameter of 25 mm [12-130] in HIV-HCV versus 21 mm [13-90] in HCV patients. Tumour portal thrombosis was found in 10/35 HIV-HCV (including 5 infiltrative form) versus 0/35 in HCV patients (28.5% and 0%, respectively, p=0.028). Portal hypertension signs were seen in 29/35 (83%) HIV-HCV patients and in 22/35 (63%) HCV patients.
Conclusion: Compared to HCV mono-infected reference patients, HCC in HIV-HCV co-infected patients revealed to be at a more advanced stage at diagnosis with a significantly higher occurrence of infiltrative form and of tumour portal thrombosis.

B-0533 10:39

Preoperative T-Staging of gallbladder carcinoma using gadoxetic acid-enhanced MR imaging: emphasis on usefulness of the hepatobiliary phase

E. Oh, J. Hwang, Y. Kim, S. Hong; *Seoul/KR (sophiaoes@naver.com)*

Purpose: To evaluate diagnostic performance of gadoxetic acid-enhanced MR imaging with an emphasis on the usefulness of hepatobiliary phase (HBP) in the preoperative T-staging of gallbladder carcinoma.
Methods and Materials: Sixty-six patients with surgically confirmed gallbladder carcinoma underwent MR imaging. Two radiologists independently reviewed two sets of gadoxetic acid-enhanced MR imaging without HBP and with HBP. Local tumour spread was evaluated according to the T-staging, and the results were compared with pathologic findings. The diagnostic performance of two image sets to differentiate each T-stage was compared.
Results: The sensitivities of MR imaging with HBP to differentiate T1 versus ≥ T2 lesions, ≤ T2 versus ≥ T3 lesions, and ≤ T3 versus T4 lesions were 96.3%, 85.7%, and 100% for observer 1, and 92.6%, 95.2%, and 100% for observer 2, respectively ($P < 0.0001$). By adding HBP, the sensitivities to differentiate ≤ T2 versus ≥ T3 lesions were increased from 66.7% to 85.7% for observer 1 and from 81.0% to 95.2% for observer 2, although there was no significant difference ($P > 0.05$). The overall accuracies for T-staging were increased from 80.3% to 86.4% for observer 1, a statistically significant degree ($P = 0.046$), and from 83.8% to 87.9% for observer 2 ($P > 0.05$). The k value for the two observers indicated excellent agreement.
Conclusion: Gadoxetic acid-enhanced MR imaging provided acceptable diagnostic performance for the preoperative T-staging of gallbladder carcinoma. Addition of HBP aid in the detection of liver invasion.

B-0534 10:48

The prevalence of potentially serious incidental findings on abdominal magnetic resonance imaging: a systematic review

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Purpose: To perform a systematic review to estimate the prevalence and types of incidental findings on abdominal magnetic resonance (MR) imaging to inform the design of the UK Biobank multi-modal imaging study of 100,000 middle-aged participants.
Methods and Materials: We searched authors' files, Medline and Embase for studies published in any language by June 2013 which reported the prevalence of incidental findings on abdominal MR in adult patients or apparently healthy volunteers. We defined serious incidental findings as those likely to threaten lifespan, quality of life or major body functions. One reviewer selected studies for inclusion and a second independently checked 10% of the references. We extracted data on incidental findings, participant characteristics and imaging variables
Results: We included 11 studies of 85,322 participants (mean age 51 years, 42% female). The largest (n=79,121 patients) only assessed incidental abdominal aortic aneurysms (0.94% (95% confidence interval [CI] 0.8-1.1%). Of the remaining 6,201 participants, 3,959 had incidental findings which were potentially serious in 413 (6.7%, 95% CI 6.1-7.3%), including 104 suspected malignancies. The most frequent non-malignant serious findings were pancreatic cysts (n=154), ascites (n=76) and pleural effusion (n=21). Potentially serious incidental findings were detected more frequently in studies which used contrast compared to non-contrast imaging (23% vs 2%). One study (n=132) used a 3 T scanner, and the remainder used 1.5 T scanners.
Conclusion: Potentially serious incidental findings are common on abdominal MR and will often require further investigations. This should be discussed with research participants and patients when seeking informed consent.
Author Disclosures:
L.M. Gibson: Research/Grant Support; unding from UK Biobank to attend educational meetings. **C.L.M. Sudlow:** Other; UK Biobank Chief Scientist.

B-0535 10:57

Qualitative analysis of small (≤2 cm) regenerative nodules, dysplastic nodules and well-differentiated HCCs with gadoxetic acid MRI

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Purpose: To evaluate radiological findings and diagnostic accuracy of gadoxetic acid magnetic resonance imaging (MRI) in the evaluation of small (≤2 cm) regenerative nodules (RN), dysplastic nodules (DN) and well-differentiated hepatocellular carcinomas (HCCs).
Methods and Materials: Sixty-two cirrhotic patients, with 107 focal liver lesions were prospectively recruited. MR examinations were performed with a 3 T magnet (Discovery MR750; General Eletric Systems). The MRI study protocol included T1-weighted and T2-weighted pre-contrast sequences and 3D-spoiled gradient-echo T1-weighted post-contrast sequences Gd-EOB-DTPA-enhanced obtained during the arterial, portal-venous and equilibrium phases ≈25 s, 70 s 180 s and after 20 m. All lesions (33 RN, 29 DN and 45 HCCs) were pathologically confirmed. One radiologist not involved in the datasets analysis reported the signal intensity characteristics of each lesion. Two radiologists blinded to clinical and pathological information evaluate radiological dataset images. Sensitivity, specificity and diagnostic accuracy were considered for statistical analysis.
Results: Regenerative nodules usually show enhancement during the arterial phase without wash-out sign during portal-venous and delayed phase. Dysplastic nodules tend to do not show enhancement during the arterial phase and present wash-out on delayed phase. Well-differentiated HCCs very often show typical vascular pattern (wash-in and wash-out) and low-signal intensity during the hepatobiliary phase. According to the AASLD radiological diagnosis the mean sensitivity, specificity and diagnostic accuracy in the diagnosis of HCC were, respectively (76.4%, 80%, 0.84).
Conclusion: Gadoxetic acid MR imaging is a reliable tool in the characterisation of well-differentiated HCC from dysplastic and regenerative nodules.

B-0536 11:06

Comparison of PET fused with MR, PET/CT and MR alone in characterising hepatic lesions

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Purpose: To compare PET fused with MR (fused-PET/MR), PET/CT and MR with gadolinium ± diffusion weighting for detecting and characterising hepatic lesions.
Methods and Materials: This is a retrospective review of 36 hepatic lesions in 20 patients (mean age 58 years ±14 yrs). All patients had both a PET/CT and MR scan. The mean time between scans was 42 days ± 30 days. PET/CT and MR scans were fused using the HERMES® software and reviewed by 2 readers, who used a scale of 1-5 to characterise lesions as benign (1), malignant (5) or indeterminate (3). The final diagnosis was determined by histopathology or follow-up imaging. PET/CT and MR alone were later reviewed independently to avoid bias.
Results: 36 lesions were detected using fused-PET/MR and MR alone. 28/36 were detected with PET/CT alone. 26/36 were benign lesions and 10/36 were metastatic hepatic lesions. All lesions were correctly characterised as benign or malignant by PET/ MR. 31/36 lesions were correctly characterised by MR alone. All 28 lesions detected by PET/CT alone, were correctly characterised. 5 indeterminate lesions on MR were correctly characterised by the addition of PET/CT
Conclusion: MR has a high sensitivity (100%) for detecting hepatic lesions, however, it correctly characterises only 86% of these lesions. PET/CT has a lower sensitivity for detecting lesions (78%), however, it correctly characterised 100% of those lesions detected. Fused-PET/MR is able to correctly characterise those lesions indeterminate on MR alone. Fused-PET/MR provides optimal sensitivity and characterisation of hepatic lesions.

B-0537 11:15

Interest of shear wave elastography in the determination of malignancy for focal liver lesions

W. Ben Hassen, M. Wagner, L. Chami, S. Egels, J.-M. Correas, O. Lucidarme; *Paris/FR*

Purpose: To assess the stiffness of various focal liver lesions (FLL) using Supersonic Shearwave Elastography (SSE).
Methods and Materials: SSE were performed in 115 patients (mean age:56.2 years; range 21-89) with 121 FLL (79 benign, 42 malignant, mean size: 27.4 mm). Final diagnosis was assessed with pathological examination in all cases of malignant and atypical benign lesions, and with CT or MRI when typical patterns of hemangiomas or focal nodular hyperplasia (FNH) were found. Three consecutives measurements in kilopascals were performed in the center of each lesion and in surrounding normal parenchyma. Average values and the ratio between values of elasticity in FLL and values of elasticity of normal liver were then computed.
Results: 79 benign lesions (40 hemangiomas, 23 FNH, 6 adenomas, and 10 others benign lesions), and 42 malignant lesions (16 hepatocellular carcinomas and 26 metastases) were analysed. Malignant lesions exhibited a mean stiffness value of 52.78kPa±32.85, whereas benign lesions had an elasticity value of 25.03kPa±18.9; $P < 10\text{-}4$). The ratio between FLL and surrounding normal liver was more important in malignant lesions (5.8±4.3) than for benign ones (3.8±2.95; $P < 0.002$). Mean stiffness values differed significantly between the three groups of lesions (benign lesions, HCC and metastases: Metastases exhibited the highest values of stiffness ($P < 10\text{-}4$) and highest stiffness ratio ($P < 10\text{-}4$). Hepatic hemangiomas showed the lowest values of stiffness compared to the other lesions ($P < 10\text{-}4$).
Conclusion: SSE provides additional information that potentially could help in liver lesion characterisation with US, particularly to differentiate benign lesions from HCC and metastases.

B-0538 11:24

Pattern of HCC recurrence after liver transplantation: time to modify the current follow-up imaging modalities?

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Purpose: To analyse the imaging characteristics of hepatocellular carcinoma (HCC) recurrence following liver transplantation (LT) in order to determine whether the current follow-up imaging modalities are relevant in the detection of these recurrences.
Methods and Materials: Among 336 cirrhotic patients undergoing LT between 2000 and 2011, 25 (7.4%) experienced HCC recurrence. Their pre-LT characteristics, long-term outcome and imaging characteristics of recurrences were retrospectively analysed.
Results: All patients were males [median age 54 (41-64) years]. Before LT, 13 (52%) patients had lesions outside the Milan criteria. Median time to HCC recurrence was 13.8 (1-75) months following LT and 8 (32%) patients experienced recurrence > 24 months after LT. Recurrences were detected using routine US follow-up in only 7 (28%) patients, and CT/MRI imaging in 18 (72%) of the patients including 5 (20%) based on alpha-fetoprotein elevation. The most frequently involved organs were the lungs in 13 (52%) cases and the bones in 9 (36%) cases. Recurrent HCC involved > 1 organ in 11 (44%) patients. Recurrences were limited to the liver in one (4%) patient, were exclusively extrahepatic in 18 (72%) patients and were both intrahepatic and extrahepatic in six (24%) patients.
Conclusion: Routine US examination alone failed to detect most HCC recurrences. Because HCC recurrence may occur even in patients with favourable prognostic factors, is mainly extra-hepatic, may be delayed, and is rarely identified using US examination, we suggest performing regular whole-body imaging during follow-up visits 2 years or more after LT.

B-0539 11:33

Alignment of abdominal organs in a sequential PET/MRI

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Purpose: A commonly discussed disadvantage of sequential PET/MRI is the effect of spatially and temporally displaced PET and MRI acquisitions. This study aims to quantitatively evaluate automatic image fusion of upper abdominal organs, which are subject to breathing movement.
Methods and Materials: 11 patients with PET and MRI acquisitions of the upper abdomen were evaluated under an IRB-approved PET/CT (Philips Gemini TF) and PET/MRI (Philips Ingenuity TF) protocol. Volumes of interest (VOIs) were defined in a unified coordinate system for the liver, spleen and kidneys. Dice coefficients were used to evaluate the overlap of corresponding VOIs in PET and CT from PET/CT. The same procedure was performed for image fusion of PET with the best-matching MRI, PET and the worst-matching MRI, as well as both MRI sequences fused. Dice coefficients were interpreted analogously to Kappa statistics (0.61-0.8 = good, > 0.8 = excellent).
Results: Overlap of VOIs in PET/CT was excellent for the liver (0.84±0.08) and good for the spleen (0.75±0.06) and each kidney (0.74±0.12, 0.79±0.05). PET and best MRI overlap was excellent in liver (0.85±0.03) and spleen (0.80±0.06) and good in each kidney (0.75±0.07, 0.78±0.07). The results were comparable with the worst-aligned PET/MRI. Overlap was excellent in all organs when comparing fused MRI sequences.
Conclusion: Despite sequential PET and MRI acquisitions, organ overlap in PET/MRI has been found robust and comparable to PET/CT.
Author Disclosures:
C. Rubbert: Other; CWRU Fellowship 2012/13 funded, Koninklijke Philips Electronics NV. **A.A. Kohan:** Other; Fellowship funded, Koninklijke Philips Electronics NV. **J.L. Vercher-Conejero:** Other; Fellowship funded, Koninklijke Philips Electronics NV. **K.A. Herrmann:** None. **R.R.F.J. Muzic:** Research/Grant Support; Koninklijke Philips Electronics NV. **P.R. Ros:** Investigator; Koninklijke Philips Electronics NV. **P.F. Faulhaber:** Investigator; Koninklijke Philips Electronics NV.

B-0540 11:42

64-row perfusion CT of hepatocellular carcinoma with the axial shuttle technique and adaptive statistical iterative image reconstruction: preliminary experience

L. Faggioni[1], E. Neri[1], G. D'Ippolito[2], F. Pancrazi[1], B. Ginanni[1], R. Sacco[1], G. Bresci[1], C. Bartolozzi[1]; [1]*Pisa/IT*, [2]*São Paulo/BR (lfaggioni@sirm.org)*

Purpose: To assess the feasibility of CT perfusion imaging (pCT) of hepatocellular carcinoma (HCC) on a 64-row scanner with extended lesion coverage and adaptive statistical iterative image reconstruction.
Methods and Materials: Nineteen patients (total 24 HCC) underwent pCT on a high-definition 64-row CT scanner (Discovery CT750 HD, General Electric) with z-axis coverage of 8 cm obtained through continuous table toggling (axial shuttle) and an adaptive statistical iterative reconstruction algorithm (ASiR™). All pCT examinations were performed using a low-dose protocol (tube voltage 80 kV, current 200 mA, rotation time 0.4 s) and 40% ASiR at 5 mm slice thickness. Blood flow (BF), blood volume (BV), mean transit time (MTT), hepatic arterial fraction (HAF), and permeability-surface product (PS) were computed in HCC and in the surrounding liver parenchyma. The rate of non-assessable HCC lesions and dose-length product (DLP) values were compared with those of 14 patients (total 23 HCC) previously evaluated on a 64-row scanner with standard filtered backprojection (FBP) and 4 cm coverage.
Results: BF, BV, HAF, and PS were higher, and MTT lower in HCC than in the surrounding liver parenchyma ($p < 0.01$). The rate of non-assessable lesions and DLP were lower with the 8 cm coverage, ASiR scanner than with the 4 cm coverage, FBP scanner (11% vs 26%, p=0.015 and 215.8±77.1 vs 598.2±135.4 mGy·cm, $p < 0.01$, respectively).

Conclusion: Compared with a standard pCT protocol, 64-row pCT of HCC lesions with extended lesion coverage and adaptive statistical iterative reconstruction can yield a significantly higher rate of assessable lesions with a lower radiation dose.

10:30 - 12:00 **Room D**

Chest

SS 904

Interstitial lung disease, lung function and infection

Moderators:
E. Castañer; Sabadell/ES
A.P. Parkar; Bergen/NO

B-0541 10:30

Comparison of HRCT data in idiopathic pulmonary artery hypertension (IPAH) and normals using fractal dimension analysis

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Purpose: To investigate if a difference exists in the lung microstructure on high-resolution CT (HRCT) images between patients with idiopathic pulmonary artery hypertension (IPAH) and normal individuals using fractal dimension (FD) analysis (an index of complexity).
Methods and Materials: A retrospective analysis was performed on 42 patients (mean age 51.8, range 21-84 years, sex 15 males, 27 females) confirmed with IPAH and 16 normals (mean age 41.5, range 21-75 years, sex 7 M, 9 F). The IPAH group underwent HRCT and concurrent right heart catheterisation. The normals undertook HRCT and pulmonary function testing. Pulmonary regions of interest were assessed with FD analysis. The minimum, maximum and mean fractal values were compared for the two groups. The fractal values for the IPAH group were correlated with the following catheterisation parameters: mean arterial pressure (MAP), pulmonary vascular resistance (PVR) and pulmonary vascular resistance index (PVRi).
Results: Significant differences in the fractal values between the two groups were observed. Comparing IPAH with normals, the minimum (34.3 ± 9.43 vs 49.3 ± 6.40), maximum (78.5 ± 9.34 vs 103 ± 12.9) and mean (56.4 ± 9.37 vs 76.2 ± 7.33) fractal values were all significantly less ($p < 0.0001$) in the IPAH group. However, no significant correlation was found between the fractal values and the MAP, PVR and PVRi in the IPAH group.
Conclusion: The lung parenchyma of patients with IPAH has significantly different CT complexity compared with normal individuals. This may provide a useful non-invasive marker for screening and monitoring treatment response.
Author Disclosures:
E. Chan: Employee; Janssen-Cilag Ltd, Johnson & Johnson.

B-0542 10:39

Quantitative CT in the follow-up of functionally stable lung transplant recipients

M. Silva[1], D. Kienzl[2], C. Mueller-Mang[2], P. Jaksch[2], W. Klepetko[2], A.A. Bankier[1]; [1]*Boston, MA/US*, [2]*Vienna/AT (mariosilvamed@gmail.com)*

Purpose: To quantify lung parenchymal changes in functionally stable lung transplant recipients using combined inspiratory and expiratory CT.
Methods and Materials: Twenty patients after double lung transplantation, all of which were stable with regards to clinical presentation and lung function (i.e., no evidence of graft rejection), underwent yearly combined inspiratory and expiratory CT examinations over 5 years. Lung parenchymal densitometric and quantitative airway metrics were calculated with dedicated software. The longitudinal evolution of the metrics was compared within individual patients, and relative changes were compared between individuals. Comparisons were performed using analyses of variance for repeated measurements, and linear regression analyses were used for data modeling.
Results: Over the 5-year study period, CT measured lung weight and histogram peaks showed statistically significant ($p = 0.012$ and $p < 0.001$, respectively) decreases. Moreover, mean lung density (MLD) significantly decreased ($p = 0.029$), with regression lines showing similar slopes between patients ($F = 2.69$; $p = 0.036$). Simultaneously, MLD on expiratory CT examinations also significantly decreased ($p = 0.001$), while quantitative airway metrics such as wall thickness, wall area percentage and Pi10 did not significantly change over time.
Conclusion: On quantitative CT, functionally stable lung transplant recipients show a consistent pattern of longitudinal tissue loss, combined to increasing gas trapping. None of these changes are detected by the lung function test currently used as reference standard for following these patients.

B-0543 10:48

Impact of iterative reconstructions on detection of systemic sclerosis (SSc): related interstitial lung disease: clinical experience in 55 patients

F. Pontana, A.-S. Billard, K. Yasunaga, S. Bendaoud, J.-B. Faivre, M. Remy-Jardin; *Lille/FR (fpontana@gmail.com)*

Purpose: To evaluate the impact of iterative reconstructions on the depiction of SSc -related lung infiltration.
Methods and Materials: 55 patients were enrolled in a study comparing reduced-dose and full-dose images simultaneously available from the same dataset acquired on a dual-source CT unit with (a) both tubes set at similar energy (120 kVp); (b) the total reference mAs (i.e., 110 mAs) split up in a way that 40% was applied to tube A and 60% to tube B. Two series of images were generated: (a) full-dose images (generated from both tubes), reconstructed with FBP (Group 1) (i.e., the reference standard); (b) reduced-dose images (generated from tube A; 60% dose reduction) reconstructed with SAFIRE (Group 2).
Results: In Group 1: (a) the mean level of objective noise was 26.23 ± 9.40 HU; (b) CT features of lung infiltration were depicted in 38 patients (69.1%) in whom the following findings were seen: fine reticular opacities (38/55; 69.1%); mild ground glass opacities (GGO) (38/55; 69.1%); bronchiectasis/bronchiolectasis (27/55; 49.1%) and honeycombing (17/55; 30.9%). Comparing Group 2 and Group 1: (a) despite dose reduction, the objective noise was significantly reduced (22.02 ± 6.94 HU; $p < 0.001$); (b) there was a similar detection of interstitial lung disease in 38 patients ($p=1$); (c) similar subjective depiction of bronchiectasis/bronchiolectasis ($p=0.776$) and honeycombing ($p=1$); (d) improved visual depiction of fine reticular opacities and GGO ($p=0.0186$); and (e) similar good interobserver agreement ($k > 0.8$).
Conclusion: The image quality and diagnostic value of reduced-dose images reconstructed with SAFIRE is comparable to that of full-dose FBP images.

B-0544 10:57

Impact of scanning conditions in the evaluation of pulmonary blood volume with dual-energy CT: results in 42 subjects

F. Molinari, P. Felloni, F. Pontana, N. Tacelli, T. Santangelo, M. Remy-Jardin; *Lille/FR (martine.remy@chru-lille.fr)*

Purpose: To evaluate the characteristics of pulmonary blood volume (PBV) on dual-energy CT examinations.
Methods and Materials: 42 patients were eligible to this study on the basis of (a) the absence of respiratory disease after a diagnostic work-up including a dual-source, dual-energy chest CT angiographic examination; (b) that was rated with an excellent image quality. Qualitative analysis was based on visual assessment. Quantitative analysis measured the (a) iodine concentration per lung (IPIPE software; Siemens) and (b) regional distribution of iodine after semi-automatic division of each lung into 18 areas (OSIRIX).
Results: The iodine (I) concentration did not significantly differ between the right (R) (1.54 ± 0.43 mg I/mL) and left (L) (1.53 ± 0.41 mg I/mL) lungs with a mean attenuation of 41.35 HU (R lung) and 41.14 HU (L lung) ($p=0.49$). Three regional gradients of attenuation were observed : (a) infero-superior ($p < 0.001$), linked to the conditions of examination (mean Δ : -6.23 in the R lung; -5.96 in the L lung); (b) postero-anterior ($p < 0.001$) due to gravity (mean Δ : 11.92 in the R lung; 15.93 in the L lung) et (c) cortico-medullary ($p < 0.001$) (mean Δ: -9.35 in the R lung; -8.37 in the L lung). The intensity of the postero-anterior ($r=0.42$; $p < 0.001$) and cortico-medullary ($r=0.58$; $p < 0.0001$) gradients was correlated to the overall iodine concentration. 7% of segments (59/840) showed artifacts hampering perfusion analysis, related to beam-hardening (RS1; RS2) or cardiac motion (RS5, LS5) artifacts.
Conclusion: Distribution of PBV is influenced by physiological gradients and scanning conditions.

B-0545 11:06

In vivo visualisation of pulmonary emphysema using grating-based x-ray dark-field imaging

K. Hellbach[1], A. Yaroshenko[2], A. Velroyen[2], F. Bamberg[1], K. Nikolaou[1], M.F. Reiser[1], F. Pfeiffer[2], A.Ö. Yildirim[3], F.G. Meinel[1]; [1]*Munich/DE*, [2]*Garching/DE*, [3]*Neuherberg/DE (katharina.hellbach@med.uni-muenchen.de)*

Purpose: Conventional chest radiographs have a limited sensitivity for the detection of mild to moderate emphysema. The purpose of this study was to assess whether grating-based x-ray dark-field imaging can be used to visualise pulmonary emphysema in vivo in a small-animal model.
Methods and Materials: To generate a murine model of pulmonary emphysema, three female C57BL/6N mice were treated with a single orotracheal application of porcine pancreatic elastase (100 U/kg body weight) dissolved in phosphate-buffered saline (PBS). Three control mice received

PBS. Mice were imaged in vivo using a prototype grating-based small animal scanner. The anaesthetised mice were breathing freely during the image acquisition. The resulting images were processed using Fourier decomposition to obtain transmission images (equivalent to a conventional radiograph) and x-ray dark-field images. In vivo pulmonary function tests were performed before sacrificing the mice and analyzing the lungs by histopathology.
Results: Pulmonary function tests and histopathology confirmed that mice in the elastase group but not in the PBS group had developed emphysema after 21 days. Specifically, histopathology demonstrated diffuse airspace widening and loss of normal alveolar architecture. Tissue elastance was significantly lower in the emphysema group than in the control group (18 vs. 34 cmH_2O/mL). The dark-field signal intensity of the lung parenchyma was significantly lower in the emphysema group compared to the control group allowing for a clear discrimination between healthy and emphysematous mice.
Conclusion: X-ray dark-field projection images can be used to diagnose pulmonary emphysema in living mice.

B-0546 11:15

Imaging of pulmonary emphysema: correlation of FEV1% with quantitative volumetric CT analysis of pulmonary volume and emphysema

F. Doellinger[1], R.-H. Huebner[1], J.-M. Kuhnigk[2], N.F. Schreiter[1], C. Haberstroh[1], V. Froeling[1], A. Poellinger[1]; [1]*Berlin/DE*, [2]*Bremen/DE (felix.doellinger@charite.de)*

Purpose: FEV1/FVC ratio (FEV1%) is an important clinical parameter in the evaluation of patients with COPD and pulmonary emphysema (PE). The aim of this study was to assess correlations between FEV1% and parameters of quantitative volumetric CT analysis.
Methods and Materials: 33 patients with confirmed COPD GOLD IV and PE were evaluated with inspiratory and expiratory chest CT. We performed computerised quantitative analysis of lung parenchyma to detect total lung volume and proportionate emphysema. The used software MeVisPULMO 3D (v3.42, Fraunhofer MEVIS, Bremen, Germany) can detect lung areas with a physical density below -950 HU and determine the ratio of normal and emphysematous lung parenchyma (i.e. emphysema score). We calculated the relative differences of lung volumes and emphysema scores between inspiration and expiration.
Results: FEV1% ranged from 12.0 to 42.0% (mean 26.50%). The relative differences of lung volumes between inspiration and expiration ranged from 67.38 to 99.71% (mean 85.62%). There was a strong statistical correlation of low FEV1% and small differences of lung volumes ($p < .005$). The relative differences of emphysema scores between inspiration and expiration ranged from +11.94 to -45.21% (mean -20.95%). There was a strong statistical correlation of low FEV1% and small differences of emphysema scores ($p = .026$).
Conclusion: Small relative differences of lung volumes and emphysema scores between inspiratory and expiratory CT show a significant correlation with low FEV1% in patients with COPD GOLD IV and PE.

B-0547 11:24

Digital tomosynthesis vs radiography in detection of fungal pneumonia: a computer simulated clinical trial

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Purpose: Compare simulated digital tomosynthesis (sim-DTS) to radiography in the detection of fungal pneumonia, using chest computed tomography (CT) as the gold standard.
Methods and Materials: 52 patients with fungal pneumonia and 13 normal controls were identified that had undergone unenhanced chest CT and chest radiograph within a 7 day period. Fungal pneumonia was confidently identified on CT, the gold standard, but was marginally detectable on radiography. Sim-DTS images were created from the CT examination. Four cardiothoracic radiologists with minimal tomosynthesis experience reviewed the images and rated likelihood of fungal pneumonia on a 1 to 10 point scale. Diagnostic performance was evaluated by ROC analysis. Area under the curve (AUC) and specific performance was compared for both modalities.
Results: All cases of fungal pneumonia demonstrated pulmonary nodules. Median largest nodule size was 18 mm. Observer performance for all readers showed area under the curve (AUC) of 0.83 for tomography (95% CI: 0.78-0.89) and 0.79 for radiography (95% CI: 0.72-0.85). There is no statistically significant difference between tomography and radiography (p-value = 0.28) performance in fungal pneumonia detection. When considering a desired sensitivity of 90%, specificity was 29% for tomography (95% CI:30-43) and 36% for tomography (95% CI:25-58).
Conclusion: This study suggests that digital tomosynthesis performs as well or better than radiography, despite being interpreted by radiologists with minimal or no tomosynthesis experience. When interpreting studies to maximise sensitivity, tomosynthesis may have higher specificity, which would significantly reduce unnecessary CT exams in neutropenic patients who are routinely screened for infection.

Author Disclosures:
G. Kicska: Grant Recipient; General Electric.

B-0548 11:33

The development of diagnostic accuracy and search pattern behaviour in the interpretation of chest radiographs

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Purpose: To investigate the development of radiological image interpretation skill through medical training by measuring both diagnostic accuracy and eye movements during visual search.
Methods and Materials: Five Consultant Radiologists, deemed the reference expert group, four Radiology Registrars, five Senior House Officers (SHOs) and six Interns formed four clinician groups. Participants were shown 30 chest radiographs, 14 of which had a pneumothorax and were asked to give their level of confidence as to whether a pneumothorax was present. Receiver operating characteristic (ROC) analysis was carried out on diagnostic decisions. Eye movements were recorded by a Tobii TX300 eye tracker. Four Eye-tracking metrics were analysed. Variables were compared to identify any differences between groups.
Results: All data were compared using the Friedman non-parametric method. The average area under the ROC Curve for the groups increased with experience (p=0.009). Statistically significant difference in diagnostic accuracy was found between Consultants and Registrars (p=0.046). All four eye-tracking metrics reduced with experience, this was statistically significant for Registrars compared with SHOs. The total reading time reduced with experience; significantly for Registrars compared to SHOs (p=0.046) and between SHOs and Interns (0.025).
Conclusion: Reader performance increased with experience. The level of experience at which there was a statistically significant difference was higher for diagnostic accuracy than for eye-tracking metrics. This data would suggest that specific training is needed to improve radiology expertise and that the development of an "expert" search pattern predates the development of "expert" levels of diagnostic accuracy.

B-0549 11:42

Comparison study of chest radiography, digital tomosynthesis and low-dose MDCT to detect ground-glass nodules: an anthropomorphic chest phantom study

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Purpose: The purpose of this study was to evaluate the comparison of diagnostic performance of chest digital tomosynthesis (DT), chest radiography (CR) and low-dose CT (LDCT) for the detection of ground-glass opacity (GGO) pulmonary nodules, using an anthropomorphic chest phantom.
Methods and Materials: Artificial pulmonary nodules (diameter: 5 and 8 mm, CT densities: -630 and -800 HU) were placed in a phantom and total 40 samples of different nodule settings underwent CR, DT and LDCT. The images were randomly read by 3 blinded radiologists. Free-response receiver-operating characteristic (FROC) were used to compare the differences in detection accuracy between CR, DT and LDCT.
Results: The figures of merit for the FROC curves averaged for the observers were 0.41, 0.37, and 0.76 for CR, DT and LDCT, respectively. FROC analyses revealed significantly better performance ($P < 0.05$) of LDCT than CR and DT for the detection of GGO nodules. The detectability difference between CR and DT was not statistically significant (P=0.73). The inter-observer agreements between three readers were 0.176, 0.510 and 0.719 for CR, DT and LDCT.
Conclusion: The diagnostic performance of DT for the detection of GGO pulmonary nodules was not significantly different to CR, and LDCT showed significantly better performance than CR and DT. DT may not be an alternative method to CT for the detection of GGO nodules, and LDCT is preferred to detect GGO nodules.

B-0550 11:51

Trachea morphology on CTPA: correlation with extent and distribution of adipose tissue

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Purpose: Excessive expiratory tracheal collapse on CT is associated with tracheomalacia. However, other factors such as obesity may also contribute to this feature. We aim to evaluate the relationship between thoracic adiposity and tracheal collapse in a nonselected group of patients.
Methods and Materials: A consecutive group of non-selected patients undergoing CT pulmonary angiograms (CTPAs) over a four-month period for suspected pulmonary embolus were retrospectively analysed by two thoracic radiologists. Exclusion criteria included intubation and mediastinal masses. Using an adapted scoring system, the morphology of the trachea was evaluated as normal or demonstrating anterior bowing of the posterior wall to a

mild, moderate or severe degree. The cross-sectional area of the trachea at its narrowest point was also recorded. Additionally, measurements of adiposity were taken, including anterior mediastinal fat thickness, sagittal thoracic diameter and subcutaneous fat thickness. The data was analysed using multinomial logistical regression.
Results: 296 patients were included. Both moderate and severe bowing of the posterior trachea were significantly correlated with sagittal thoracic diameter ($p < 0.0001$) and with mediastinal fat thickness ($p < 0.005$). Tracheal cross-sectional area was inversely correlated with subcutaneous fat thickness ($p=0.005$). Tracheal cross-sectional area was lower in females than in males ($p < 0.0001$).
Conclusion: These findings demonstrate a statistically significant relationship between thoracic adiposity and trachea morphology in a large nonselected population being evaluated for pulmonary embolus. Therefore, the CT diagnostic criteria for tracheomalacia may vary with body habitus.

10:30 - 12:00 **Board Room B**

Head and Neck

SS 908

Imaging techniques

Moderators:
K.S.S. Bhatia; Shatin/HK
H.B. Eggesbø; Oslo/NO

B-0551 10:30

70 kV ultra-low dose computed tomography of the paranasal sinus: diagnostic image quality and radiation dose
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Purpose: To evaluate diagnostic image quality and radiation dose of 70 kV CT low-dose technique of the paranasal sinus.
Methods and Materials: CT of the paranasal sinus was performed on 3x40 age- and sex-matched patients at different tube voltages and currents (70 kV/75 mAs, 100 kV/40 mAs [standard low dose protocol], 120 kV/40 mAs [standard protocol]). CTDIvol, DLP, attenuation, image noise and SNR were compared between the groups using Mann-Whitney U test. Subjective diagnostic image quality was compared using a 5-point scale (1 = worst, 5 = best, 2 readers in consensus) and Cohen's weighted kappa analysis for inter-observer agreement.
Results: Radiation dose was significantly lower in 70 kV than 100 and 120 kV (DLP: 32 mGycm vs. 52 mGycm vs. 82 mGycm; CTDI 2.3 mGy vs. 4.0 mGy vs. 6.3 mGy, $p < 0.05$). Mean SNR (120 kV: 0.13; 100 kV 0.20; 70 kV 0.37, $p < 0.05$) and organ attenuation increased statistically significantly with lower kV, while image noise decreased (mean: 120 kV: 82±11 HU; 100 kV 81±37; 70 kV 191±26, $p < 0.05$). All examinations showed diagnostic image quality. Subjective diagnostic image quality was higher in standard protocols than in 70 kV protocol (120 kV: 5.0; 100 kV 4.5; 70 kV 3.5, $p < 0.05$) and was not rated significantly differently with good inter-observer agreement ($k > 0.59$).
Conclusion: 70 kV ultra-low dose CT of the paranasal sinus allows significant dose reduction of -61%, better attenuation of organ structures in comparison to standard protocol while remaining diagnostic image quality with a slight reduction in subjective image quality.

B-0553 10:39

Application of IDEAL T2- and postcontrast T1-weighted fat-suppressed FSE imaging in head and neck at 3 T: evaluation of quality improvement
J. Hong, H. Lee, Y. Kang, M. Lim, M. Kim, S. Cho; *Incheon/KR (ifiamyou82@naver.com)*

Purpose: To compare fat-suppressed MRI quality using iterative decomposition of water and fat with echo asymmetry and least-squares estimation (IDEAL) with that using frequency selective fat-suppresion (FSFS) T2- and postcontrast T1-weighted fast spin-echo images in extracranial head and neck at 3 T.
Methods and Materials: This prospective, single-center study was institutive review board approved. MRI was performed in 28 individuals of a routine patient collective. The axial T2- and postcontrast T1-weighted imaging with IDEAL and FSFS were compared. Visual evaluation of following items was performed by two experienced, independent readers: 1) artifacts around oral cavity, airway, paranasal sinus, and head-neck junction, 2) uniformity of fat suppression, 3) image sharpness, 4) contrast of pathologies and lymph nodes to surrounding tissue. Statistical evaluation was done by using the Wilconxon's singed rank test.
Results: Both IDEAL T2- and postcontrast T1-weighted imaging significantly reduced artifacts around airway, paranasal sinus, and head-neck junction, and significantly improved uniform fat suppression ($p < 0.05$, respectively). IDEAL significantly decreased artifacts around oral cavity on T2-weighted images, and significantly improved lymph node-to-tissue contrast on postcontrast T1-weighted images ($p < 0.05$, respectively). However, no significant improvement was found on lesion-to-tissue contrast.
Conclusion: IDEAL T2- and postcontrast T1-weighted imaging improves image quality by reducing the degree of artifacts around airway, paranasal sinus, and head-neck junction, and providing uniform fat saturation of the head and neck.

B-0554 10:48

Inner ear CT imaging: influence of iterative reconstruction techniques on dose and image quality
F. Zanca[1], W. Coudyzer[1], I. Bosmans[2], A.-S. Delabie[2], K. Op de beeck[1], R. Hermans[1]; [1]*Leuven/BE*, [2]*Brussels/BE (federica.zanca@uzleuven.be)*

Purpose: To assess dose reduction potential using Sinogram Affirmed Iterative Reconstruction (SAFIRE) relative to filtered backprojection (FBP) on temporal bone computed tomography (CT).
Methods and Materials: Two cadaver heads were scanned on 128-slice multi-detector-row CT (SOMATOM Definition Flash) using the standard-of-care protocol (140 kV, 220 fixed mAs) and dose reduced protocols at 200, 180 and 160 mAs (10, 20, 30% dose reduction, respectively). In addition, the standard-of-care with lower potential (120 kV) but higher mAs (250) (30% dose reduction) was also used. Data were reconstructed with FBP and SAFIRE (strength 5), using very sharp filters. Objective noise and Hounsfield units were measured in the native axial (0.4 mm slice, 0.2 mm increment) and reformatted coronal and axial (0.8 mm slice, 1 mm increment) images. Signal to noise ratio (SNR) was calculated and the two techniques were compared (Student t-test). Two neuroradiologists assessed the images for visibility of ear structures and for diagnostic image quality, using a 5-point scale (1=insufficient; 5=excellent).
Results: Objective noise was significantly lower for SAFIRE with respect to FBP for the native images (117±6.6 vs 132±8.1, $p < 0.05$). SNR followed the same trend. Subjective image quality analysis was significantly better for FBP (p-value< 0.001, SAFIRE median score 3 vs 4 for FBP).
Conclusion: Compared with FBP, SAFIRE enabled significant reduction of objective image noise for the high-resolution native images which also yield a more confident evaluation of very small structures (e.g. the ossicular chain). However, overall image quality was significantly better for FBP, possibly because of the extreme strength of 5 for SAFIRE.

B-0555 10:57

Reduction of MR imaging artefacts caused by cochlea implants: a phantom study
A. Pomschar, F. Dirr, J. Müller, M.F. Reiser, B. Ertl-Wagner;
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Purpose: To evaluate the effect of an advanced metal artefact suppression MR sequence (warp), which combines view angle tilting (VAT), increased bandwidth and slice-encoding metal artefact correction (SEMAC), on magnet-induced artefacts caused by cochlea implants in an experimental setup.
Methods and Materials: Measurements were performed on a phantom in a 3 T MRI scanner (Magnetom Skyra, Siemens Healthcare). The phantom consisted of a plastic grid cube of 15x15x15 cm, 1 cm grid, immersed in a copper sulphate solution with a cochlear implant, placed at 1 cm depth. 3D T1-weighted images were acquired with and without "warp" technology, with VAT set to 50 and 100%, respectively. Signal void penetration into the grid cube was measured from the bottom of the CI receiver to the maximum depth of the signal void. Signal void area around the CI receiver was measured in the plane of the CI receiver.
Results: Signal void on T1-weighted sequences without metal artefact suppression showed a penetration depth of 8.2 cm and an in-plane area of 167 cm². With activated "warp" technique and 50% VAT, penetration depth was reduced by 41% to 4.8 cm and area by 72% to 47 cm², with 100% VAT, depth was reduced by 49% to 4.2 cm and area by 76% to 40 cm².
Conclusion: An advanced metal artefact suppression algorithm combining VAT, SEMAC and increased bandwidth significantly reduces susceptibility artefacts caused by cochlear implants at 3 T. It has the potential to increase the diagnostic value of cranial imaging in patients with CI.
Author Disclosures:
A. Pomschar: Equipment Support Recipient; The Syngo"warp" sequence was provided by SIEMENS Healthcare.

B-0556 11:06

MR tractography of the intraparotid facial nerve

A. Attye, I. Troprès, A. Karkas, C. Righini, G. Bettega, A. Krainik; *Grenoble/FR*

Purpose: Identifying the facial nerve (VII) after the stylomastoïd foramen remains a modern imaging challenge. We attempt to visualise the VII up the proximal facial nerve division (FND) among patients admitted for parotid lesion with diffusion tensor imaging (DTI). Then, we attempt to validate this method by comparison with the surgeon findings.
Methods and Materials: DTI was performed on a 3 T Philips Achieva® MRI Scan with a 32 channels array head coil. We used both the Philips navigational software Fibertrack® and free software MRtrix® to obtain facial nerve fiber tracking with the single Region of Interest method. The fraction of anisotropy has been set to 0.05 and the maximal angle change to 80°. The location of the FND in relation to the tumour was correlated with the data of the DTI during the tumour resection by the surgeon. The correlation study included a visual analysis and use of a monitoring of the VII (Avalanche® device).
Results: We performed a DTI study of the facial nerve among 16 patients with focal parotid lesion before surgery. Fibres corresponding to the course of the main trunk of the VII were identified with the DTI-based fiber tracking technique in all patients. The visualisation of the FND allows us to define two parts of parotid gland, superficial and deep, and to successfully locate the process into in all cases in relation with the surgeon findings.
Conclusion: DTI study of the VII up the FND seems to be feasible and potentially useful before management of focal parotid lesion.

B-0557 11:15

Normal variation of hypoglossal canal

M. Osawa, T. Kanda, T. Kiritoshi, K. Toyoda, H. Oba, S. Furui; *Tokyo/JP (funimarun@gmail.com)*

Purpose: Double hypoglossal canal and size laterality of the hypoglossal canal are major normal variations of the canal, but the true incidences of these variations, or sex and laterality differences are not known. We investigated the normal variation of the hypoglossal canal using 64-slice CT and MRI.
Methods and Materials: 596 consecutive patients (mean age, 61 years: range, 15-94 years: 257 male, 339 female) underwent CT. 2 radiologists independently reviewed their CT images and counted the canal number on each side. If the canal was single, the hypoglossal canal size was measured. 61 patients who had undergone MRI, were checked for the hypoglossal nerve. Steel-Dwass test was used, and statistical significance was established at a p-value of < 0.05.
Results: The incidence of double hypoglossal canal was 16.9%. Right double hypoglossal canal of women was significantly rarer than that of men or that of the left side. Bilaterally, double hypoglossal canal was significantly rarer in women than in men. In single hypoglossal canal patients, left side predominant laterality was observed in 31.9% of patients and right side predominant laterality in 12.1%. In the 61 patients who had undergone MRI the hypoglossal verve existed within all hypoglossal canals.
Conclusion: Both double hypoglossal canal and size asymmetry of hypoglossal canal are common. Right side double hypoglossal canal of women was significantly rarer than that of men or that of the left side.

B-0558 11:24

Facial asymmetry and temporomandibular joint

R. Oca Pernas, E. Santos, N. Silva, A. Fernández, A. Grande, A. Bustos; *Vigo/ES (roqueoca@hotmail.com)*

Purpose: 1). To evaluate mandibular ramus length and condyle size in patients with facial asymmetry. 2). To determine if the diagnose of facial asymmetry is a conditioning for the development of degenerative changes in temporomandibular joint (TMJ).
Methods and Materials: 25 non-contrast facial CT of patients referring from Maxillofacial Surgery Department with clinical diagnosis of facial asymmetry were retrospectively analysed; 25 non-contrast facial CT for preoperative assessment of unerupted molar teeth extraction were chosen as controls. Mandibular ramus length and axial diameters (minor and major) of condyles were measured. Degenerative changes of TMJ were evaluated independently by two blinded radiologists with quantitative scale of 4 points (0: no degenerative changes; 3: advanced joint destruction). In case of disagreement, a consensus reading was conducted. Anatomic differences and degenerative changes were analysed. Interobserver reliability was calculated.
Results: 1). Short mandibular ramus length was 57.6 and 64.1 mm for patients and controls, respectively ($p=0.002$). There were no statistical differences in long mandibular ramus length between both groups. 2). Mandibular condyles diameters, either in short or long ramus sides, were smaller in patients with facial asymmetry ($p=0.015$ and $p=0.013$). 3). TMJs presented more severe degenerative changes in patients ($p < 0.001$), being more extensive in short ramus side condyle ($p=0.014$). 4). Interobserver reliability was 0.84 and 0.86 for long and short ramus sides.
Conclusion: 1). Patients with facial asymmetry show shorter mandibular ramus length and smaller condyles. 2). TMJ degenerative changes are more severe in patients with facial asymmetry, mainly in short mandibular ramus side.

B-0559 11:33

Mandibular incisive canal (MIC): visibility and path of the intramandibular course using cone beam computed tomography (CBCT)

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Purpose: The interforaminal mandibular region is considered a safe zone for implant surgery; nevertheless literature reports neurosensory disturbances of the lower lip from 7% to 24% of cases after implant placement in this area. The aim of this retrospective study was to assess the visibility and path of intramandibular course of MIC using CBCT.
Methods and Materials: 140 patients (280 hemimandibles) were included in this study. The visibility, diameters and distances from anatomical landmarks in the interforaminal region (root tips, buccal, lingual and inferior cortex of the mandible) were measured twice by two observers using CBCT in consensus. Coefficient of repeatability (CR) and limits of agreement were calculated by Bland-Altman method.
Results: CBCT identified MIC at root tips of first premolars, canines and lateral incisors in 70%, 46.1% and 15.4%, respectively. At the same landmarks, the mean diameters were 1.4 mm, 1.1 mm and 0.9 mm (CR range: 0.4-0.6 mm); the mean distances from the root tips were 5.7 mm, 6.3 mm and 8 mm (CR range: 0.7-1.2 mm); the mean distances from buccal cortex were 3.0 mm, 5.0 mm and 5.1 mm (CR range: 0.7-1.2 mm); the mean distances from lingual cortex were 5.3 mm, 4.6 mm and 4.9 mm (CR range: 0.5-0.9 mm).
Conclusion: Even though the MIC is usually only partially corticalised, therefore difficult to trace in some cases, the variability of measurements of MIC using CBCT was reasonably small, with the potential to improve the precision of implant surgery planning in the interforaminal region.

B-0560 11:42

Quality assurance of dental digital imaging in Finland in health care facilities having CBCT devices

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Purpose: In October 2011, Radiation and Nuclear Safety Authority Finland published a guide presenting the radiation safety requirements concerning dental x-ray practices and quality assurance procedures. The aim of this study was to describe dental x-ray quality assurance procedures performed in Finland, and dental imaging staff's educational needs associated to them.
Methods and Materials: Target group of the study was all the health care organisations in Finland having the cone beam CT in their use. The data were collected by a postal questionnaire during spring 2012 and 25/33 questionnaires were returned. The questionnaire comprised 39 questions, out of which ten were open-ended, 23 structured and 6 half-structured questions. The data were analysed by using PASW Statistics 18 program.
Results: Dental health care quality assurance tests were well performed. The most common quality assurance tests were mechanical and an emergency switch tests. Almost all the respondents (22/25) had received some kind of life-long education in dental digital imaging quality assurance (QA). However, only 11 of them had received QA-education during their professional education. Participators wanted continuous and regular training. They also wished revision to basic radiation protection and practical training. There came also up a wish for cone beam CT training for dental hygienists.
Conclusion: State of quality assurance in dental digital imaging in Finland is quite good. However, education of the topic is still needed. Most urgently is needed education for the basic radiation protection issues and cone beam imaging quality assurance issues.

10:30 - 12:00 **Room E1**

Musculoskeletal

SS 910

Tumours

Moderators:
T. Bäuerle; Erlangen/DE
J.L. Bloem; Leiden/NL

B-0561 10:30

Does apparent diffusion coefficient values can be used for the differentiation of small-blue-round cell tumours from malignant non-small-blue-round cell tumours?

F.B. Ergen, G. Yildirim, I.C. Kose, J. Karakaya, B. Aydin, U. Aydingoz;
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Purpose: The purpose of this study is to assess the ability of apparent diffusion coefficient (ADC) values in differentiating small-blue-round cell tumours (SBRCT) and malignant non-small-blue-round cell tumours (NSBRCT) of the musculoskletal system.
Methods and Materials: For a period of 1.5 years, patients presented with SBRCT (n=10) and NSBRCT (n=8) who underwent conventional MRI and diffusion-weighted imaging (DWI) were included to this study. None had received anti-neoplastic therapy and all were pathologically confirmed. For each mass, two observers independently measured 3 different ADC values from the areas that demonstrate the lowest diffusivity. The difference between the medians of SBRCT and NSBRCT was assessed with Mann-Whitney test. The optimal cut-off ADC value was determined with ROC analysis.
Results: Eighteen patients (mean age, 54 years) with final diagnosis of Ewing's sarcoma (n=7), Langerhans cell histiocytosis (n=2) multiple myeloma (n=1), PNET (n=1), osteosarcoma (n=4), mixoid liposarcoma (n=2), chondrosarcoma (n=1), were included. Median ADC values of SBRCT and NSBRCT were $0.57\pm0.18x10^{-3}$ and $1.03\pm0.61x10^{-3}$ mm^2/sec for observer 1; and $0.55\pm0.19x10^{-3}$ and $1.04\pm0.58x10^{-3}$ mm^2/sec for observer 2, respectively. We found a statistically significant difference between the median ADC values for both observers (P=0.006). Intraclass correlation coefficient was 94% (95% CI, 86.5%-98.0%). The area under ADC ROC curve was 0.88 (95% CI, 0.64-0.98). The optimal cut-off point was 0.69 $x10^{-3}$ mm^2/sec. For this cut-off point, sensitivity and specificity were 85.7% and 81.8%, respectively.
Conclusion: Apparent diffusion coefficient values can be used in differentiation of SBRCT from malignant NSBRCT in patients with musculoskeletal tumours.

B-0562 10:39

Imaging follow-up of large and symptomatic soft tissue lipomas

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Purpose: Lipomas > 5 cm, below deep fascia or symptomatic have malignant potential and UK national recommendations are for excision. However patient reluctance and anatomical location can make surgery unattractive. We prospectively studied patient outcomes for lipomas referred to a sarcoma service for surgery but managed conservatively.
Methods and Materials: Prospective series of 80 patients referred to a sarcoma service with lipomas > 5 cm, deep to fascia, symptomatic and/or minor atypical imaging features initially managed conservatively. All lesions measured and interval growth defined as percentage increase from initial dimensions. Minor atypical imaging features defined as internal septal thickening/blood flow, heterogenous echogenicity on ultrasound or mild incomplete MRI fat suppression (not nodular). Clinical follow-up and imaging surveillance was performed.
Results: 26 lipomas were subcutaneous, 10 intra-fascial, 12 inter-muscular and 32 intra-muscular. Conservative management occurred because: location (20), co-morbidity (3), pregnancy (1), and patient choice (56). At presentation 80 had ultrasound and 59 MRI. 8/59 had MRI atypical features (8 incomplete fat suppression, 2 septal enhancement) and another 8/80 ultrasound atypical features (septation low blood flow or thickening). 46 were > 5 cm on MRI and 54 on ultrasound. Mean follow-up was 12 months (range 8-32). No lesions with atypical imaging showed significant interval growth. 9 lesions showing interval growth (range 7.1- 56%) all demonstrated stability on at least one subsequent scan and 3 cases underwent surgery with histology and cytogenetics confirming lipoma.
Conclusion: This study demonstrates that large, deep or symptomatic lipomas where surgery is not immediately indicated can be safely followed up with MRI/Ultrasound.

B-0563 10:48

Frequency of MR parameters in soft tissue synovial sarcoma: comparison between different histopathologic type

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Purpose: To evaluate the frequency of the magnetic imaging (MRI) parameters in synovial sarcoma. To assess the correlations between MRI parameters and histopathological types of synovial sarcoma, as well as to select specific MRI parameters that could possibly predict the histological type of synovial sarcomas.
Methods and Materials: MRI findings of 43 cases (23 males, 20 females, median age 40 years) of synovial sarcoma of the soft tissue were retrospectively analysed. Monophasic was 24 cases (56%), biphasic 17 (39.5%) cases and two were low differentiated synovial sarcomas. Twenty-four MRI parameters were evaluated. Besides descriptive statistics, Spearman rank-order correlations, Mann-Whitney U test and Multivariate regression analysis were performed.
Results: Deep and extracompartmental localisations were found in 79% of the cases. Most of the cases were with iso signal intensity (SI) in T1 and high and inhomogeneous SI in T2, with peripheral (53%) and inhomogeneous (88%) enhancement. Both cystic areas and necrosis were present in 53%. Mostly, haemorrhage and fluid-fluid levels were absent. Multilocular configuration was observed in 12 (28%) cases. Sixty three percent of the cases had well-demarcated margins, and in the same percentage two different solid areas were present. Bone and joint involvement was rare. Multiple regression analysis showed that there were no MR parameters significantly predictive for the histopathological type of synovial sarcomas. There were no statistically significant differences between the monophasic and biphasic synovial sarcomas for none of the evaluated parameters.
Conclusion: Evaluated MR parameters cannot reliably predict the histopathologic types of synovial sarcoma.

B-0564 10:57

Myxoid containing tumours of soft tissues: MRI appearance with radiologic-pathologic correlation

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Purpose: To identify specific MRI features and to correlate with pathology in a large series of histologically proven myxoid soft tissue tumours (STT).
Methods and Materials: 63 patients with myxoid STT were included. All patients underwent MRI before surgery. Definite histological diagnosis was obtained after surgical resection in all cases. Following criteria were analysed: before contrast injection: tumour location relative to the fascia, lesion margin, signal homogeneity, peritumoural oedema; presence of hyperintense T1 WI peripheral rim (fat split sign). After contrast injection: tumour enhancement; presence of tail sign. Correlation with pathology focused on: T2WI fluid-like or hypo-intensity areas compared to myxoid, necrotic and fibrotic tissue; loss of hyper-T1 signal on fat-sat sequence compared to adipose tissue.
Results: Histopathology was low-grade fibromyxoid sarcoma (LGFMS), myxofibrosarcoma (MFS), myxoid liposarcoma (MLPS), and myxoma in 8, 23, 20 and 12 cases, respectively. All myxoma and LGFMS were intramuscular while all MLPS were intermuscular. 75% MFS invaded both fascial and deep structures. Myxoid matrix was found in 75% MLPS and 90% myxoma; LGFMS and MFS showed heterogeneous mild T2 signal with fibrous tissue at histology. When present, fatty T1 hypersignal was specific of MLPS and tail sign specific of MFS.
Conclusion: Myxoid STT are a heterogeneous group of mesenchymal tumours with characteristic imaging features. MR results give the basis of decision-making by a multidisciplinary committee.

B-0565 11:06

Assessment of the preoperative chemotherapy of soft tissue sarcomas using anatomical and functional methods of visualisation

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Purpose: To increase and compare the informativeness of MRI, changes in tumor size and DCE-MRI in assessment of the preoperative chemotherapy of soft tissue sarcomas (STS) by developing differential criteria (decisive rule - DR) of poor and good response (PR/GR) to treatment.
Methods and Materials: To develop the DR for different methods of visualisation 74 patients with STS were analysed (74 with MRI, 37 with DCE-MRI). Plus MRI was used to estimate the changes in the tumor size according to RECIST criteria. The DR was created using multifactor analysis whereby statistically significant radiological signs acquired weight coefficients (WC),

which determined the frequency of occurrence of symptoms in a group of patients with GR and PR.
Results: The sensitivity of DR for MRI was 65%, the specificity - 86%; for DCE-MRI - 100% and 84%, of RECIST criteria - 50% and 100%, respectively. The most informative MRI and DCE-MRI signs with the highest WC were: decrease of a proposed solid component, increase of the thickness of pseudocapsule and disappearance of enhancement, type II of the curve of the tumor for GR; increase/appearance of cystic component, preservation of surrounding edema and diffuse type of enhancement, type V of the curve of the tumor for PR.
Conclusion: MRI (qualitative and RECIST criteria) with its higher specificity better predicts PR, DCE-MRI shows higher values of sensitivity associated with GR. The combination of anatomical and functional methods improves the quality of evaluation of the treatment in patients with STS (sensitivity - 100%, specificity - 96%).

B-0566 11:15

Pilomatricoma: radiologic findings of 17 cases

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Purpose: The purpose of this study is to evaluate the characteristic findings of pilomatricoma on x-ray, CT, and MRI and to correlate the imaging findings with histopathologic features.
Methods and Materials: We retrospectively reviewed X-ray (n=3), CT (n=8), and MR (n=8) findings of 17 cases in 171 consecutive patients pathologically confirmed pilomatricomas during 2006-2012. The radiologic findings of various tissues within tumours were evaluated by x-ray, CT, and MRI. The study population included 10 men and 7 women with a mean age of 27.3 years (range 2-94 years). The lesions were located in the subcutaneous fat layer of the head and neck (n=9), extremity (n=8). Imaging findings of all cases were compared with histopathologic findings.
Results: On MRI, in all cases, tumours showed isointensity compared with adjacent skeletal muscle on T1, T2WI. But on T2WI, 6 of 8 cases showed various degree of reticular and/or patchy hyperintense area. On CT, 6 of 8 cases showed isodensity compared with skeletal muscle. Four cases combined low-density areas, partially. Seven of 8 cases had combined calcification. Four cases showed fine and other 3 cases showed coarse nodular calcification. In comparison with pathologic finding, isointensity areas on T1, T2WI and iso- or high-density areas on CT compared with skeletal muscle were corresponding to intercellular cement, granulation, fibrosis and calcifications. And low-density areas on CT and reticular and amorphous high-intensity areas on T2WI were corresponding to basaloid cells and ghost cells within tumour.
Conclusion: Radiologic findings of pilomatricoma have some characteristic findings which are fine and/or spotted calcifications (X-ray, CT)and isointensity compared with skeletal muscle combined funicular or reticular high-intensity area (T2WI). These findings were useful for differential diagnosis.

B-0567 11:24

Neurovascular invasion by soft-tissue sarcoma: assessment with MR imaging in 174 cases

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Purpose: To evaluate MR imaging in the assessment of neurovascular invasion by soft-tissue sarcoma.
Methods and Materials: MR images of 174 patients with soft-tissue sarcoma who subsequently underwent resection/amputation were analysed by two readers. To assess neurovascular invasion, extent of contact between tumour and neurovascular structures was classified using a five-point scale (no contact, contact ≤90°, 91-180°, 181-270°, > 271°). Interobserver agreement in quantifying contact between tumour and neurovascular structures was calculated using kappa coefficients. Imaging findings were correlated with intraoperative findings and/or results of histopathology. ROC analysis was performed to determine the optimal threshold value to predict neurovascular invasion.
Results: Intraoperative evaluation/histopathology confirmed neurovascular invasion in 25.3% of patients. Interobserver agreement in quantifying contact between tumour and neurovascular structures was excellent for arteries, veins and nerves (kappa: 0.85/0.89/0.89). ROC analysis revealed an optimal threshold value of > 180° for the prediction of arterial, venous and neural Invasion for Reader1 and for arterial and venous invasion for Reader2, whereas the threshold value for nerves was > 270° for Reader2. Using these cut-off values, sensitivities/specificities in diagnosing invasion of arteries, veins and nerves were 84.6%/97.5%, 84.6%/97.5% and 77.8%/93.2% for Reader1 and 84.6%/93.8%, 84.6%/94.7% and 72.2%/97.3% for Reader2. The areas under the ROC curves for arteries, veins and nerves were 0.95/0.95/0.93 (Reader1) and 0.95/0.96/0.92 (Reader2).
Conclusion: MR imaging allows reliable and accurate assessment of neurovascular invasion by soft-tissue sarcoma. Neurovascular invasion should be diagnosed, if contact between tumour and vascular/neural circumference exceeds 180°.

B-0568 11:33

Ultrasound-guided biopsy in bone lesions: how and when it can be done. Preliminary results

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Purpose: Bone biopsy is usually under CT guidance. The aim of this study is to propose US guided biopsy in specified bone lesions with cortex interruption but without soft tissue involvement.
Methods and Materials: From January 2012 to February 2013, thirteen patients underwent an US guided biopsy for a bone lesion. The lesions, always characterised by a cortex interruption, were located in the lower limb (3 cases), in the upper limb (4), in the chest (3), and in the pelvis (3). To assess the diagnostic accuracy we evaluated agreement between the diagnosis made on bone tissue specimens from needle biopsy and either the final diagnosis or the clinical evolution (whether not further surgically treated) by means of Cohen's kappa. This coefficient is a statistical measure of inter-rater agreement for categorical items.
Results: In 10 cases out of 13 the diagnosis was obtained correctly. The diagnosis were myeloma (3 cases), metastases of carcinoma (3), metastases of sarcoma (1), giant cell of the bone (2), Tietze's disease (1), not diagnostic biopsy (3). On 13 patients 5 tumors types were diagnosed, so that 5 items were considered for Kappa coefficient calculation. In three patients insufficient material was obtained to allow a histological diagnosis. In the remainder 10 patients a perfect agreement was observed (k=1, $p < 0.05$).
Conclusion: In accurately selected cases the biopsy of bone lesions can be performed under US guide. This technique is eventually more time effective and does not use ionising radiation. Further studies are needed to confirm our results.

B-0569 11:42

Magnetic resonance guided focused ultrasound surgery for osteoid osteoma

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Purpose: This work presents the six months after and the preliminary experience in the treatment of osteoid osteoma by magnetic resonance guided focused ultrasound surgery (MRgFUS), at the Rizzoli Institute.
Methods and Materials: Six patients affected by osteoid osteoma were treated by MRgFUS (ExAblate 2100, InSightec, Israel on 1.5 T Signa Twin Speed MR-system, GE, USA), and were followed at 1, 3, and 6 months after the procedure. Only osteoid osteomas with typical presentation, according to clinical and imaging findings, were recruited. Pain and function were scored before and after MRgFUS.
Results: Patients were all males, ageing 18-46 years old (BMI 26.2±4.9, range 19.3-34.5 Kg/m2) and presented with pain scoring 5 to 10 on a visual analogue scale basis [VAS - 0-10 scale]). All osteoid osteomas were located at femur (head/neck in 4, diaphysis in 2), and in one case a recurrence after radiofrequency ablation was treated. No intra- and post-procedure complications or adverse effects were observed. VAS immediately dropped to 2.3±1.6 (0-5, at discharge) ($p < 0.001$), and flattened to 0 in all patients from the 1-month check. At 6 months, no pain or function limitations were present.
Conclusion: MRgFUS is safe, and extremely effective in the treatment of osteoid osteoma. This interventional procedure pushes the front of treatment to an even less invasive approach, and this may represent a true competitor of any other method in today's clinical management of osteoid osteoma.

B-0570 11:51

MRgHIFU treatment in pain palliation of bone metastases: initial experience from the Rizzoli orthopaedic institute

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Purpose: Bone metastases are the most common cause of cancer-related pain. The aim of this work was to assess the efficacy of MRgHIFU in the treatment of pain caused by bone metastases, in the preliminary cohort of patients treated at our Institute.
Methods and Materials: From November 2012, 16 patients affected by bone metastases were enrolled in the study. Pain and quality of life were scored before and after MRgHIFU (ExAblate 2100, InSightec, Israel on 1.5 T Signa Twin Speed MR-system, GE, USA). A clinical follow-up was performed at 1, 3 and 5 months.
Results: Twenty lesions were treated in 16 patients (7 males, 9 females, age range 47-83 years) with different primary cancers (4 breast, 4 kidney, 3 lung, 3

thyroid, 1 colon, 1 rectum). The treated lesions were located as follows: 17 at pelvis (85%), 2 at femur, 1 at rib. In five patients the bone lesion was single. Treatments were performed under spinal anesthesia in 14/16 patients, under general anesthesia in 2/16. Two patients died during the follow-up (approximately 2 months after the treatment), while ten patients reached the 3-month check point, and five the 5-month one. According to visual analogue scale (VAS, 0-10 points) results, the average pain drop after 1 month amounted to 57%, and this was 86% at both 3 and 5 months from baseline (all $p < 0.01$), with 3 out of 5 patients presenting VAS=0.
Conclusion: Our preliminary experience shows the efficacy and the safety of MRgFUS in controlling the pain of bone metastases from different primary cancers.

10:30 - 12:00 **Room F1**

Oncologic Imaging

SS 916
Emerging applications of diffusion-weighted MRI

Moderators:
A. Luna; Jaen/ES
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B-0571 10:30
Is whole-body diffusion-weighted imaging all we need for detecting metastases in melanoma patients?
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Purpose: To investigate whether whole-body diffusion-weighted imaging (WB-DWI) is adequate for detecting metastases in melanoma patients or must be combined with contrast-enhanced WB magnetic resonance imaging (ceWB-MRI).
Methods and Materials: One-hundred and forty-seven WB-DWI and ceWB-MRI studies were performed quarterly in 23 patients with advanced melanoma. The reference standard was biopsy, other imaging, or changes on follow-up. Findings of metastasis in separate WB-DWI and WB-DWI+ceWB-MRI readings were compared using κ statistics.
Results: Eleven patients were metastatic by reference standard. At reading, 14 patients were considered positive and 9 negative for metastases by WB-DWI: 9 proved to be TP, 5 FP, 7 TN and 2 FN. Fifteen patients were considered positive and 8 negative for metastases by WB-DWI+ceWB-MRI: 10 TP 5 FP, 7 TN and 1 FN. Both techniques failed to detect the presence of metastasis in a patient with local recurrence, and WB-DWI failed in one with case of brain metastasis. There was almost perfect agreement between techniques for detection of patients with metastases (κ = 93.7 %, 95 % CI 81.5-100 %). A total of 21 metastatic findings were observed by reference standard, of which 16 were detected using WB-DWI (16 TP, 5 FN, 6 FP), and 19 using WB-DWI+ceWB-MRI (19 TP, 2 FN, 12 FP). Both techniques failed to detect a lung metastasis and a local recurrence, and WB-DWI did not detect three brain metastases.
Conclusion: WB-DWI without additional WB-ceMRI sequences is promising for detecting extracranial metastases in melanoma patients, but contrast-enhanced MRI is required for brain evaluation.

B-0572 10:39
Possibilities of diffusion-weighted magnetic resonance imaging in detection of peritoneal dissemination in case of recurrent ovarian cancer
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Purpose: To determine the possibilities of DWI MRI in detection of dissemination on the peritoneum of abdomen and pelvis in patients with ovarian cancer, who underwent specialised antineoplastic therapy, with the presence of recurrence according to the results of oncomarker test.
Methods and Materials: The study included 28 female patients (age range: 41 to 69 years) with the presence of recurrence according to the results of oncomarker test. All the patients underwent MRI, whose data were subsequently compared with the histopathological examination of remote specimens. MRI was performed in two stages: the first one was carried out with the use of a protocol that included Sg T2, Ax T2, Cor T2 FatSat, Obl-Ax T2, Obl-Cor T2 and Co T1; the 2nd - with addition of DWI MRI to the standard protocol.
Results: The indicators of MRI diagnostic effectiveness when using the standard protocol were the following: accuracy 50%, sensitivity 48%, and specificity 66%. The informativity measures when using the DWI MRI method increased to: 92% for accuracy, 93% for sensitivity and 100% for specificity.
Conclusion: The use of DW MRI significantly increases the diagnostic efficiency measures of the technique in the diagnosis of recurrent ovarian cancer. Considering the high technique informativity, it is recommended to be obligatory included into the examination protocol for monitoring of patients, who underwent specialised antitumour treatment for ovarian cancer.

B-0573 10:48
To analyse whether values of ADC have a correlation with survival and with epidermal growth factor receptor amplification in glioblastoma
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Purpose: To analyse whether values of apparent diffusion coefficient (ADC) have a correlation with survival and with epidermal growth factor receptor (EGFR) amplification in glioblastoma (GBM).
Methods and Materials: 49 patients with untreated GBM were analysed and underwent a diffusion-weighted imaging study before surgery (mean=6 days). Mean follow-up (18.69 months-DS ± 10.3). A ROI was drawn on ADC map in the highest restriction region of the tumor and on the normal-appearing contralateral white matter (NCWM). ADC-min values were evaluated as well as ADC-index defined as a ratio between tumoral ADC-min and NCWM-ADC mean. EGFR amplification, tumoral volume, residual volume, progression-free survival (PFS) and overall survival (OS) were analysed. Student *t* test, reciever operating curves (ROC), Kaplan-Meier and Cox regression model were performed.
Results: 30 patients had EGFR unamplified. 39 patients had complete resection. Presurgical tumoral volume (mean=42.1 cm^3) and postsurgical volume (mean=0.65 cm^3) had no association with survival. Both ADC-values and ADC-index were not related with EGFR amplification. On Kaplan-Meier analyses, EGFR amplification was correlated better with a decrease in PFS (p=0.029), while ADC-index> 0.7 correlates better with OS ($p < 0.001$). EGFR-unamplified patients with ADC-index< 0.7 had a significant decrease in PFS (p=0.002) and OS ($p < 0.01$). Patients with EGFR amplification and ADC-index> 0.7 had better OS than patients with ADC-index< 0.7 (p=0.028), without differences in PFS. The ADC-index value of 0.7 represents the best cut-off value for predicting OS. ADC-index was a significant predictor variable on Cox regression model (p=0.024).
Conclusion: The EGFR amplification is significantly correlated with PFS, while ADC-index condition OS in GBM. EGFR and ADC-index could be strong pretreatment predictors of survival in patients with GBM.

B-0574 10:57
Predicting treatment response in lymphoma: value of pretreatment apparent diffusion coefficient and its early change during chemotherapy
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Purpose: To evaluate usefulness of pretreatment apparent diffusion coefficient (ADC) and its early change during chemotherapy to predict treatment response in lymphoma.
Methods and Materials: Whole body MRI with diffusion weighted imaging (b=0 and 800 s/mm^2) was performed in 19 patients (26-76 years) with morphologically confirmed lymphoma before treatment and repeated at the level of target lesion (largest lymph node) after first, before and after second cycles of chemotherapy. ADC was measured on three adjacent slices and averaged to get target lesion ADC. Tumors were considered responding to treatment if product of two maximal perpendicular diameters decreased by more than 50%.
Results: Pretreatment ADC was equal to 0.99×10^{-3} mm^2/c and increased by 47%, 74% and 88% after first, before and after second cycles of chemotherapy. Product of tumor diameters before treatment was equal to 3089 mm^2 and decrease by 43%, 47% and 74% correspondingly. There was a positive correlation between pretreatment ADC and residual tumor size after first (r = 0.47, p = 0.057), before (r = 0.51, $p < 0.03$) and after second (r = 0.60, $p < 0.01$) cycles. In ROC-analysis pretreatment ADC cut-off of 0.69×10^{-3} mm^2/c predicted tumor response after first cycle of chemotherapy with 50% sensitivity and 82% specificity (Az=0.63). Pretreatment ADC cut-off of 0.82×10^{-3} mm^2/c predicted tumor response after second cycle of chemotherapy with 60% sensitivity and 100% specificity (Az=0.85).
Conclusion: ADC increases early during treatment in parallel and does not precede decrease in tumor size. Pretreatment ADC can predict tumor response after second cycle of chemotherapy.

B-0575 11:06

Diffusion-weighted MR imaging and volume measurements in assessment of early tumour response to antiangiogenic therapy

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Purpose: To evaluate the combination of DW-MRI and volume measurements to classify placebo and therapy group in an experimental tumour model.
Methods and Materials: In 23 athymic nude rats, human colon carcinoma xenografts (HT-29) were implanted in the left flank. Animals were examined before and 7 days after treatment onset with regorafenib (n=12) or placebo (n=11) in a 3-Tesla whole-body system. For DW-MRI, a single-shot EPI sequence with 0.5×0.5×2 mm³ resolution and 9 b-values (10-800s/mm²) was used. The apparent diffusion coefficient (ADC) was calculated voxelwise by monoexponential fitting. Multi-slice regions of interest were defined covering the entire tumour, within which the median was taken as representative tumour ADC. Tumor volume was determined using a T2-weighted turbo-spin-echo sequence with 0.3×0.3×1.5 mm³ resolution and TR/TE=9560/91 ms. Observed absolute ADC and relative volume changes between first and second measurement were evaluated as classifiers by a receiver-operator-characteristic (ROC) analysis individually, followed by a Fisher's linear discriminant analysis (FLDA) combining both parameters.
Results: Sensitivity, specificity, and accuracy of the ADC-based ROC analysis were 0.875, 0.636, and 0.783, respectively (ADC-change cutoff: 0.033 mm²/10³s, above=therapy), and for the volume 0.818, 0.818, and 0.826, respectively (volume-change cutoff: 61.4%, below=therapy). The combined FLDA approach yielded a sensitivity of 0.833, specificity of 1 and accuracy of 0.913.
Conclusion: The combination of both parameters slightly decreased the sensitivity compared to using ADC alone; however, a considerable increase in specificity was achieved resulting in the highest diagnostic accuracy, thus outperforming the use of either ADC or tumour volume individually in the differentiation of therapy vs. placebo group.

B-0576 11:15

Comparison between ADC and extravascular extracellular volume in oncologic patients under chemio-radiotherapy: preliminary results

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Purpose: To compare the apparent diffusion coefficient (ADC) changes, obtained by diffusion-weighted imaging (DWI) with the extravascular extracellular volume (Vee) changes, obtained by T1 perfusion imaging (DCE-MRI), in patients receiving chemo-radiotherapy. The rationale lies in the common micro-biological interpretation of both parameters, the tissue "cell density". Consequently, their change, obtained simultaneously with independent methods, should correlate positively and linearly, within the experimental errors.
Methods and Materials: 12 consecutive patients with different tumours underwent a baseline MRI and a second MRI after two weeks from the beginning of the therapy, for early assessment of treatment efficacy. An experienced radiologist contoured a region of interest (ROI) on DWI images to localise the lesion and to obtain the mean ADC value. After a post-processing with dedicated software (Tissue4D, Siemens HealthCare, Erlangen), the same operator contoured a ROI on the considered lesion in DCE-MRI to obtain the mean Vee value. The relative variation of the two parameters, calculated as (X2weeks - Xbaseline)/Xbaseline was plotted.
Results: Our measurements, although strongly affected by experimental error, demonstrate an evident correlation between ADC and Vee: the variations of both parameters show a positive and linear behaviour for almost all of the patients under study. Only in patients with prostate cancer, the variations of ADC and Vee seem not follow any correlation.
Conclusion: ADC and Vee changes after chemo-radiotherapy appear to be closely related, confirming their dependence on cellular density, except in patients with prostate cancer in which a new interpretative paradigm seems to be necessary.

B-0577 11:24

The role of DWI as a marker of prediction of tumour grade in endometrial cancer: preliminary results

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Purpose: To evaluate the effectiveness of diffusion-weighted MRI (DW-MRI) in the assessment of tumour grade in endometrial lesions.
Methods and Materials: 54 endometrial lesions including 27 endometrial cancers and 27 benign lesions were enrolled in our prospective study. DWI was performed with b factors values of 0, 500, and 1000 s/mm^{-2}. The region of interest was defined within the tumor on T2-weighted EPI image and then manually copied to an apparent diffusion coefficient (ADC) map. Then, the ADC value was obtained and the calculation of mean ADC value was correlated with histology.
Results: The mean ADC values for histological grade 1 and 2 were 0.79 x10^{-3} mm^{2}s^{-1} and 0.73 x10^{-3} mm^{2}s^{-1} for grade 3 endometrial lesions. There was no statistically significant difference between tumour grades. The mean ADC value for endometrial carcinoma (grouping all types of tumors) was significantly lower ($p < 0.01$) than that of benign endometrial lesions. A cut-off mean ADC value of less than 1.01 x10^{-3} mm^{2}s^{-1} yielded a sensitivity, specificity and accuracy of 89.3%, 87.5% and 88.8% respectively.
Conclusion: ADC measurements can quantitatively differentiate between benign and malignant endometrial lesions. However, tumor mean ADC is not useful in the assessment of tumor grade.

B-0578 11:33

DW-MRI for the characterisation of focal liver lesions in cancer patients

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Purpose: Most studies accessing the ability of DWI-MR to differentiate benign and malignant liver lesions included cysts in the analysis. Cysts are easy to diagnose and have high ADC values what increases diagnostic accuracy of such studies. Comparison of the ADC values obtained for cysts, solid benign and metastatic liver lesions in cancer patients is presented.
Methods and Materials: ADC values of 325 liver lesions in 115 adult cancer patients were prospectively analysed. Lesions were diagnosed throughout imaging and clinical characteristics. One hundred and five benign (42 cysts, 63 solid benign) in 57 patients and 262 metastatic lesions in 58 patients were included. ADCs were obtained with 0.600 sec/mm² b values. ROC analysis was conducted to evaluate ADC performance for metastasis diagnosis.
Results: The mean ADC values were 2.3, 1.4 and 1.1 x 10-3 mm²/sec for cysts, solid benign and metastatic lesions. Benign and metastatic lesions ADCs' were different when cysts were included ($p < 0.0001$) but not when only solid benign lesions were analysed (p=0.10). The ADC cutoff value of 1.3 x 10-3 mm²/sec differentiates benign solid and metastatic lesions with an accuracy of 66%.
Conclusion: In cancer patients, ADC value cannot confidently differentiate solid benign and metastatic liver lesions. Most studies that suggest that application included cystic lesions in the evaluation and must have the results analysed with caution.

B-0579 11:42

Correlation between DWI-ADC values and histological cellularity in bone marrow biopsy in patients affected by lymphoma

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Purpose: To investigate the relationship between crest bone marrow apparent diffusion coefficient (ADC) and cellularity percentage obtained by bone marrow biopsy (BMB) in a population of patients affected by lymphoma scheduled for whole-body MR examination.
Methods and Materials: 26 consecutive patients (age 44±16 years old) affected by Hodgkin Disease (HD, 15 cases) and non-Hodgkin lymphoma (9 DLBCL and 2 MCL) underwent whole body MR, for a total of 30 studies. Seven no-hematologic patients were used as normal controls. ADC was extrapolated from diffusion-weighted data set on pelvis by whole-body SE-EPI inversion recovery imaging (b-value 800 sec/mm2), using a ROI-based method. All the hematologic patients underwent BMB (mean interval 86 days).
Results: ADC was lower in controls than in patients with lymphoma ($p < 0.0001$) and it increased significantly with bone marrow cellularity with no linear fit (p=0.002). Furthermore, ADC was significantly lower in low cellular marrow (cellularity < 30%, $p < 0.05$).
Conclusion: ADC seems to be a potential biomarker of bone marrow cellularity in patients affected by lymphoma. A prospective study on a largest population could be useful to confirm this preliminary data and to evaluate clinical implications of these findings.

B-0580 11:51

Optimisation of b-values in MR diffusion-weighted acquisitions through information theory: a mathematical justification for consensus

A. Alberich-Bayarri, R. Sanz-Requena, G. García-Martí, L. Marti-Bonmati;
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Purpose: To address the problem of b-value optimisation in DW-MR as a signal compression problem in the frame of information theory and the properties of the Fisher information matrix (FIM), focusing on 4 optimum b-values that contain most of the information of the signal and provide minimum estimation error of the diffusion parameters.
Methods and Materials: In order to analyse the amount of information of the biexponential signal decay model, the FIM was calculated, which objectivises the amount of information that an observation carries about unknown

parameters. To determine the typical biological distributions of D, D* and f values through different organs and parenchyma, a systematic literature review of relevant intra-voxel incoherent motion (IVIM) DW studies in brain, breast, abdomen, pelvis and musculoskeletal tissues was performed. The determination of the 4 optimum b-values that achieved a proper fit of the IVIM model was performed by considering the b-value 0 in conjunction with the 3 b-value ranges providing the maximums of the 3 FIM diagonal elements.
Results: The optimum b-values obtained for brain were 0, 15, 65 and 682s/mm2; for breast 0, 8, 41 and 390s/mm2; for abdomen 0, 10, 50, 351 s/mm2; for pelvis 0, 25, 110, 674s/mm2; musculoskeletal 0, 24, 110, 657s/mm2.
Conclusion: An optimum set of b-values according to information theory was obtained for different regions and biological situations in the body. The results together with a validation currently being performed with clinical data will add relevant insight into consensus over a standardised b-value sampling scheme in DW-MR.

10:30 - 12:00 **Room F2**

Breast

SS 902

MRI

Moderators:
U. Bick; Berlin/DE
J. Veltman; Almelo/NL

B-0581 10:30

Influence of background enhancement on the diagnostic accuracy of breast MRI
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Purpose: Background enhancement (BE) in breast MRI is often attributed to hormonal stimulation. Although strong BE is considered as a diagnostic challenge in clinical practice, empirical evidence for this assumption is limited. The present study aims to investigate the diagnostic accuracy of breast MRI stratified by the degree of background enhancement.
Methods and Materials: Consecutive patients undergoing breast MRI (1.5 T, unenhanced T2w and dynamic contrast-enhanced T1w sequences in concordance with international recommendations) with subsequent histological sampling of imaging detected lesions were eligible for this IRB approved retrospective study. Breast MRI were read by two experienced radiologists blinded to histopathology results in consensus. Lesions were classified according to BI-RADS. Furthermore, background enhancement (BE) was investigated and graded on an ordinal scale as "distinct" or "not distinct". Finally, diagnostic parameters were calculated and stratified by the grade of BE.
Results: 664 lesions were included (423 malignant, 241 benign). BE was "distinct" in 78 (11.7%) and "not distinct" in 586 cases (88.3%). Sensitivity and specificity of breast MRI showed only slight differences between the "not distinct" (93.0% and 81.7%) and "distinct" BE group (94.9% and 74.4%; all: P=n.s). However, the PPV (positive predictive value) was significantly lower in the subgroup exhibiting "distinct" BE (78.7%) compared to the "distinct" BE subgroup (90.6%; P=0.02).
Conclusion: Presence of "distinct background enhancement" leads to an increased false positive rate, significantly decreasing the PPV of breast MRI.

B-0582 10:39

Comparison of morphologic and dynamic characteristics of only MR-visible lesions at 1.5 T vs. 3 T according to 425 MR-guided breast biopsies
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Purpose: To compare morphological features of only MR-visible lesions at 1.5 T vs. 3 T according to the histopathology after MR-guided biopsy.
Methods and Materials: 425 MR-guided biopsies were analysed. Lesions homogeneity, margins, oedema, T2w-density, adjacent vessels, shape, etc. were analysed and matched to histopathology. 354/71 interventions were performed at 1.5 T/3 T (Philips Achieva/Ingenia). Mean lesion size was 6 and 7 mm.
Results: 285/354 and 62/71 biopsies were finished successfully (19.5% vs. 9.8%). Most of 1.5 T interventions were aborted due to claustrophobia, lack of space, the only reason for abortion at 3 T was lack of lesions visualisability. 50.8%/42.2% were proven as B2 at 1.5 T/3 T; 14.4%/24.0% as in situ and 15.3%/24.0% as malignancies. Oedema was observed more common at 3 T: benign:13.3%; in situ: 29.4%; malignant: 11.8% at 3 T (10.6%;17.6%;13.0% at 1.5 T). Spiculations were significantly more often visible at 3 T at all dignities (40.0%; 23.5%; 47.2% at benign, in situ, malignant lesions) vs. 21.7%; 25.5%; 57.4% at 1.5 T. Adjacent vessels were observed in 17.2%; 11.8%; 27.8% at 1.5 T vs. 20.0%; 23.5%; 29.4% at 3 T-based MR-guided biopsies. Ring enhancement was more common at 3 T (20.0%; 23.5%; 29.4% at 3 T vs. 17.2%; 11.8%; 27.8% at 1.5 T). Unsharp edge was more common at malignancies at 1.5; related spiculations were more obvious at 3 T (malignancies; unsharp edge 57.4% vs. 29.4%; spiculations 18.5% vs. 52.9%).
Conclusion: Morphologic characteristics differ dignity-related (malignancies are spiculated, inhomogeneous, unsharp with ring enhancement, adjacent vessel and blooming) but also according to higher resolution of 3 T-MRI. Lesion discrimination is more reliable at 3 T with a higher percentage of (pre)malignant histologies according to MR-guided biopsy. Biopsy procedure at 3 T is more comfortable due to larger bore and better positioning opportunities.

B-0583 10:48

Time-to-peak tumor sub-volume in invasive carcinomas and fibroadenomas
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Purpose: To assess the distribution of time-to-peak (TTP) intralesional signals and define the TTP tumor sub-volume (TTP Vol). in benign and malignant breast lesions, as it is known that fibroadenomas (FA) have lower blood vessel density than invasive ductal carcinomas (IDC).
Methods and Materials: Forty patients were assessed with 1.5 T unit on DCE-MRI examination with Gd-DTPA. Tumor volume (Tu Vol). was computed for each lesion, taking into consideration the three dimensions. TTP Vol. was computed for each lesion in the largest connected area of pixels at a set threshold. The lesions were histologically verified as FA (n=20) or IDC (n=20) and statistically analysed. TTP Vol./Tu Vol. ratio, as the relation between the 'hot-spot' and the whole tumor, was calculated for all lesions.
Results: The difference in Tu Vol. between the two subgroups (7.0±4.3 for IDC vs. 6.2±5.1 for FA, p=0.36), was not significant, unlike the difference in TTP Vol. in two subgroups (5.3±3.1 for IDC vs. 3.4±3.2 for FA, p=0.02). The difference in the TTP Vol./Tu Vol. ratio between the two subgroups (0.77±0.11 for IDC vs. 0.52±0.14 for FA, $p < 0.0001$) was highly statistically significant. Highly significant correlation between the 'hot-spot' volume and the whole tumor volume was confirmed for IDC (r=0.92).
Conclusion: TTP Vol. was greater in IDC compared to FA, particularly if regarded as the 'hot-spot volume' to tumor volume ratio, pointing to the correlated vascular and tumor growth observed in IDC.

B-0584 10:57

Breast MRI in the evaluation of nipple discharge: less is more
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Purpose: To analyse whether breast MRI in patients with pathologic nipple discharge adds any valuable information.
Methods and Materials: Retrospective analysis in 123 consecutive patients with a diagnosis of pathologic nipple discharge and breast MRI exams. US, mammography, cytology and galactography were performed in 93, 76, 74 and 6.5% of all patients respectively. BMRI included a T2 FSE sequence and a 3D dynamic T1 GRE sequence (spatial resolution 0.7/0.7/2 mm). MRI was considered negative when no enhancement, ductal or glandular enhancement and probably benign lesions were seen. MRI was deemed positive when segmental, irregular or nodular enhancement adjacent to the central ducts. Influence of MRI was rated as: non existent, diagnosis of a lesion, change of therapeutic approach, overdiagnosis and false negative lesions. Gold standard was pathology. No pathology with a follow-up of greater than 24 months or a benign lesion were considered negative. A diagnosis of papilloma or a malignant lesion was considered positive.
Results: MRI had no influence in 18.6%, influenced therapy in 20.3%, diagnosed a lesion in 14.6%, showed a greater extent in 5.7%, FP in 9.7%, FN in 0.8% and non conclusive in 2 patients. Mean follow-up was 27.2 months. Diagnostic accuracy in showed a sensitivity, specificity, PPV and NPV of 94.7%, 76%, 64.3% and 97% respectively.
Conclusion: MRI is very useful diagnostic tool for diagnosis in 20% and for exclusion of disease and therefore can potentially avoid further diagnostic and surgical procedures in patients with a negative study due to its almost 100% NPV.
Author Disclosures:
J. Camps-Herrero: Advisory Board; Bayer. Research/Grant Support; Bayer. Speaker; Bayer.

B-0585 11:06

Breast MRI in Pptients with unilateral hematic nipple discharge: comparison with galactography

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Purpose: to assess the role of breast MRI in evaluating Patients with unilateral hematic or sero-hematic nipple discharge in comparison with galactography.
Methods and Materials: in this retrospective study we included 53 patients with unilateral hematic/serohematic secretion who performed both galactography and MRI. We evaluated the capability of both the techniques to identify the presence/absence of ductal pathology and to distinguish benign from malignant lesions.Lesions classified as BIRADS 1/2 underwent to follow-up (performed with mammography, ultrasound or cytology)while the gold standard to assess the type of pathology in lesions classified as BIRADS 3.4 and 5 was the histological examination after surgery.
Results: after surgery and follow-up,8 patients had no pathology (15%),23 had a diagnosis of papilloma (43%),11 of papillomatosis (21%),5 of Ductal Cancer In Situ (10%)and 6 of papillary carcinoma (11%).Concerning the ability to identify the presence/absence of pathology, both galactography and MRI presented a specificity of 100% while sensitivity was 98% for MRI vs 49% of galactography.The ROC analysis was used to test the diagnostic ability of both the modalities separately considered (Galactography and MRI) compared with histological analysis. Considering MRI we found a statistically association between mass intraductal enhancement and the presence of papilloma ($p < 0.001$;AUC: 0.957; CI 0.888 -1.025),between papillomatosis and ductal enhancement ($p < 0.001$;AUC: 0.790; CI 0.623-0.958),between segmental enhancement and DCIS (p=0.007 AUC: 0.750; CI 0.429 -1.071,) and between papillary cancer and linear enhancement (p=0.011).
Conclusion: MRI can be considered a valid and alternative tool in detecting ductal pathologies showing higher values of sensitivity and specificity in comparison with galactography.

B-0586 11:15

MRI screening for silicone breast implant rupture: accuracy, inter- and intraobserver variability using explantation results as reference standard

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Purpose: In Europe the recall of PIP silicone breast implants in 2010 was followed by recommendation to remove all ruptured implants. Consequently, large numbers of asymptomatic women underwent MRI. The accuracy and interobserver variability of MRI is relevant when indications for surgery are chiefly based on MRI. Accuracy of MRI was not previously studied in a cohort of women, all of whom underwent explantation regardless of symptoms.
Methods and Materials: A prospective cohort study included 107 women with 214 PIP silicone implants who underwent explantation preceded by MRI of the breasts. Two radiologists independently reevaluated in 2013 all MRI examinations being blinded for the previous diagnoses or the outcome at surgery. A structured protocol was developed to describe the MRI findings. The ex vivo findings served as reference standard.
Results: In 208 of the 214 explanted prostheses, radiologists agreed independently about the condition of the implants. In five of the six cases they disagreed upon (2.6%), they subsequently reached a non-imposed consensus. 158 implants were correctly diagnosed as intact and 40 as ruptured. A sensitivity of 93%, a specificity of 93%, a positive predictive value of 77% and a negative predictive value of 98% was found. The interobserver agreement was excellent with a Kappa value of 0.92.
Conclusion: MRI has a high accuracy in diagnosing rupture in silicone breast implants. Considering the high Kappa value of interobserver agreement, MRI appears to be a consistent diagnostic test. A simple, uniform reporting protocol, may improve communication between radiologist and plastic surgeon.

B-0587 11:24

Prepectoral oedema as a morphological sign in MR mammography

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Purpose: To retrospectively evaluate the role of prepectoral oedema (PE) as a morphological sign in the differential diagnosis of breast lesions.
Methods and Materials: Between 01/2005 and 10/2006, a total of 1109 consecutive MRM exams have been performed in our institution. In this study, only patients who would later be biopsied or operated in our own hospital were included. They had no previous operation, biopsy, intervention, chemotherapy, hormone replacement therapy or previous mastitis. In total, 162 patients with 180 histologically correlated lesions were included. The evaluations were performed by four experienced radiologists in consensus.
Results: 180 evaluated lesions included 104 malignant lesions (93 invasive and 11 non-invasive cancers) and 76 benign lesions. PE was detected in 2.6 % of benign lesions (2/76), in none of the DCIS-cases (0/11) and in 25.8 % of malignant lesions (24/93) ($p < 0.000$). PE were found significantly more frequently in presence of malignant tumours above 2 cm in diameter [(47.1 %; 16/34) vs. (13.8 %; 8/58)] ($p < 0.001$). PE was not statistically associated to malignant tumour-type, presence or absence of additional DCIS, and number of lesions. This resulted in the following diagnostic parameters for PE as an indicator for malignancy: sensitivity of 19.3%, specificity of 97.3%, PPV of 92.3%; NPV of 48%; accuracy 57.7%.
Conclusion: In case of occurrence, the "Prepectoral Edema Sign" seems to be a specific indicator for malignant tumours with a high-positive predictive value, independent from its entity.

B-0588 11:33

Axillary node staging in patients with breast cancer on preoperative 3 T breast MRI: a pilot study

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Purpose: To assess the accuracy of 3 T magnetic resonance imaging (3 T MRI) in detecting metastatic axillary lymph nodes on routine preoperative breast MRI examination.
Methods and Materials: 72 patients with histologically proven breast cancers referred for breast MRI staging between July 2010 and June 2013 were retrospectively studied. MRI examinations were performed at 3 T, using a dedicated breast coil covering also bilateral axillary area. MRI protocol included T1, T2 and 3D sequences after dynamic injection of gadolinium, with a 0.8 mm isotropic voxel. The detectability of axillary nodes, and the presence of specific MR criteria including size, signal and morphological criteria were assessed and confronted to pathological post-operative findings.
Results: A total of 21 full axillary lymph node dissections, 45 sentinel lymph node dissections and 6 image-guided biopsy were available for pathological confrontations. 14 patients showed metastatic axillary nodes. Using combined size and morphological criteria, the detectability of axillary nodes on 3 T MRI was 79% with sensitivity, 98% specificity, and 92% NPV. Overall 11/14 N+ patients were correctly identified on MRI.
Conclusion: Metastatic axillary lymph nodes can be suggested on routine preoperative 3 T breast MRI examinations with high specificity and NPV, with figures close to those reported using dedicated axillary surface coils.

B-0589 11:42

Preoperative breast MRI: should BI-RADS 3 category be considered?

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Purpose: To compare the sensitivity (SE) and specifity (SP) of preoperative breast MRI including BI-RADS 3 category lesions as positive for malignancy or not.
Methods and Materials: 51 consecutive patients with histologically proven breast cancer and preoperative breast MRI were selected. 134 breast lesions were evaluated. Preoperative MRI images were interpreted retrospectively by two breast radiologists blinded to the final diagnosis. BI-RADS 3 lesions were included as malignant in group 1 and as benign lesions in group 2. All the lesions were compared with the gold standard (histology or follow-up). The results were collected using an excel table to calculate the sensitivity and specificity, and the statistical significance was studied using the PEPI software.
Results: Out of 134 breast lesions, 77 were histologically malignant and 57 were benign. In group 1 the SE and SP of preoperative MRI were respectively: SE (98.7 %) and SP (5.3 %). In group 2 the SE and SP of preoperative MRI were respectively: SE (92.2%) and SP (91.2%). The comparison between both groups showed statistically significance for SP (5.3% vs 91.2%, $p < 0.05$) and showed no statistically differences for SE (98.7% vs 92.2%, $p > 0.05$). Only 5 BI-RADS 3 lesions were finally malignant, all of them were separated from the main tumour less than 15 mm.
Conclusion: Considering BI-RADS-3 category as benign in preoperative MRI increases significantly the specificity without decreasing the sensitivity. All of the malignant BI-RADS 3 lesions were close to the main tumour (< 15 mm).

B-0590 11:51

Breast MRI as a problem-solving tool: systematic review and meta-analysis

B. Bennani-Baiti, P.A.T. Baltzer; *Vienna/AT*

Purpose: To assess the validity of breast MRI as a problem-solving tool.
Methods and Materials: Two investigators independently performed a systematic review using predefined search terms. Discrepancies were resolved by final consensus cross-evaluation. We selected only studies whereby breast MRI was used for problem-solving purposes i.e. inconclusive mammographic/sonographic findings. Studies that focused solely on assessing mammographic microcalcification malignancies were excluded. Standard of reference had to be established either by histopathology or follow-up

examinations. Study design, technical parameters, number of true positives, false positives, false negatives and true negatives were extracted from the original publications, and possible bias was determined using the QUADAS 2 applet. Statistical analysis included data pooling, forest plot construction, and heterogeneity testing.
Results: 11 studies met our inclusion criteria. These comprised 1062 lesions, including 777 benign and 285 malignant lesions. The negative predictive alue (NPV) ranged from 87.5 to 100%, with a pooled NPV of 99.1%. A fixed effects model was applied due to low heterogeneity (P=0.129). The positive predictive value (PPV) was highly heterogeneous (P < 0.0001) ranging from 25 to 96.4%. Based on a random effects model, the pooled PPV was 53.2%.
Conclusion: This is the first meta-analytical study to demonstrate that breast MRI can reliably exclude malignancy when applied as a problem solving tool. These **Results:** i. alleviate the controversy surrounding the use of breast MRI as a problem solving tool; ii. strongly supports its implementation as a problem-solving tool and; iii. should impact the guidelines in breast imaging.

10:30 - 12:00 **Room I/K**

Neuro

SS 911

Neurodegenerative diseases

Moderators:
S. Haller; Geneva/CH
T.A. Yousry; London/UK

B-0591 10:30

The pattern of white matter alteration in patients with Parkinson's disease according to cognitive status
S.-K. Lee, N. Shin; *Seoul/KR (c0na@yuhs.ac)*

Purpose: To assess the pattern of white matter alteration in patients with Parkinson's disease (PD) according to cognitive status by using diffusion tensor imaging.
Methods and Materials: From August 2011 till September 2012, we enrolled patients with PD-intact cognition (PD-IC, n=10), PD-mild cognitive impairment (PD-MCI, n=15), PD with dementia (PDD, n=11), and healthy control subjects (n=15). Fractional anisotrophy (FA) map of patient groups was compared with each other and that of control subjects by using tract-based spatial statistics (TBSS) where age and education were included as covariates in analysis of covariance.
Results: Compared with control subjects, FA values were significantly decreased in many major tracts in patients with PD-MCI and more PDD as follows: corpus callosum, bilateral superior longitudinal fasiculi, bilateral anterior corona radiata, bilateral anterior limbs of internal capsule, bilateral external capsule, bilateral posterior thalamic radiation, bilateral cingulum, and left inferior longitudinal fasciculus. Compared with patients with PD-IC, there were significantly decreased FA values in the body of corpus callosum in patients with PDD. There were not significantly decreased FA values in patients with PD-IC compared with control subjects. PDD patients with shorter disease duration before dementia (< 5 years) showed greater decrease in FA values than those with longer disease duration (≥5 years).
Conclusion: These data suggest that white matter damage in PD exhibits a greater extent with increasing levels of cognitive impairment. In addition, white matter alteration responsible for PDD may differ according to disease duration of PD.

B-0592 10:39

Iron load in genetic Parkinson's disease measured using MRI
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Purpose: Although most cases of Parkinson's disease (PD) are sporadic, genetic forms of PD exist. In idiopathic PD (IPD), iron load is increased in the substantia nigra (SN). The goal of this work is to measure the iron load in the SN and the basal ganglia (BG) of patients carrying genetic mutations associated with PD.
Methods and Materials: Measurements of T2 and T2* relaxation times were performed at 3 Tesla in 20 IPD patients, 20 subjects with LRRK2 or Parkin mutations related to PD (10 symptomatic patients and 10 non-symptomatic carriers), and 20 control subjects. In all cases, R2* and R2 mean values for SN and BG were calculated.
Results: R2* values were increased in IPD and mutation-carrying PD patients as compared to controls ($p < 0.0001$) and also in mutation-carrying PD patients as compared to IPD (p=0.0023). Asymptomatic mutation carriers showed R2* values higher than those of controls (p= 0.021), but not significantly different from those of IPD patients. No changes were observed for R2 values in SN and BG or R2* values in BG.
Conclusion: Iron load in the SN of the mutation-carrying subjects (symptomatic and asymptomatic carriers) was increased. Genetic PD patients showed greater iron load increases than IPD patients. Iron load, analysed with R2* can be regarded as a biomarker of the nigrostriatal degenerative changes in mutation carriers associated with neurodegeneration. The role of iron load in neurodegeneration in mutation-carrying subjects, as well as its prognostic value has yet to be elucidated.

B-0593 10:48

Is there an association between leukoaraiosis volume and diabetes?
L. Saba, R. Montisci, R. Sanfilippo, M. Piga, E.A. Genovese; *Cagliari/IT (lucasaba@tiscali.it)*

Purpose: The association between diabetes mellitus and leukoaraiosis is still debated while the association with hypertension, age and carotid artery stenosis is widely demonstrated. In this work our purpose is to evaluate the association of white matter hyperintense lesion volume and diabetes in a cohort of patients who underwent an MRI of the brain at our institution.
Methods and Materials: Fifty-four consecutive patients (mean age 72 ± 9 years, males 42) were prospectively recruited at our Institution before undergoing carotid endarterectomy. The patients were assessed for the presence of vascular risk factors, including diabetes mellitus, hypertension, hyperlipidemia. The patients underwent an admission MRI of the brain which included T2-FLAIR, T2-SE and DWI sequences. FLAIR-leukoaraiosis lesion volume was performed by a neuroradiologist, blinded to the presence of risk factors, using a semi-automated segmentation technique. ROC analysis was performed to evaluate the AUC of FLAIR-leukoaraiosis lesion volume and number of lesions with respect to the vascular risk factors.
Results: The ROC curve analysis showed an AUC of 0.725 (SE = 0.082 and 95% CI from 0.593 to 0.873) with a statistically significant p value of 0.002 between the presence of diabetes mellitus and the FLAIR-leukoaraiosis lesion volume. In the ROC curve analysis between the presence of diabetes mellitus and number of lesion the AUC was 0.715 (SE = 0.085 and 95% CI from 0.553 to 0.845) with a p value of 0.0119.
Conclusion: Our data demonstrate an association between diabetes mellitus and the volume of the cerebral white matter abnormality.

B-0594 10:57

3 Tesla brain MRI including quantitative diffusion tensor imaging to differentiate between Parkinson's disease and atypical parkinsonism
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Purpose: To evaluate 3 Tesla brain MRI in differentiating between Parkinson's disease (PD) and atypical parkinsonism (AP) in patients presenting with parkinsonism but uncertain initial clinical diagnosis. The added value of quantitative diffusion tensor MRI (DTI) was evaluated.
Methods and Materials: Prospective observational cohort study in 60 patients. At baseline brain MRI including DTI was performed followed by mean clinical follow-up of 18 months during which probable diagnoses could be made in 44 patients (26 PD, 18 AP). Brain MRI abnormalities were scored. DTI data were analysed by the region of interest (ROI) method and the discriminative power of each ROI was evaluated by multivariate logistic regression. The area-under-the-receiving-operating-curve (AUC) was used to evaluate the discriminative power of routine brain MRI and routine brain MRI combined with DTI ROI mean diffusivity (MD) and fractional anisotropy (FA) values.
Results: AUC of routine brain MRI in differentiating PD and AP was 0.75 (95% CI 0.60-0.91, sensitivity 89% and specificity 54%) when at least one abnormality was present; in case of at least two abnormalities AUC was 0.81 (95% CI 0.67-0.95, sensitivity 78% and specificity 81%). When combined with MD values in the putamen or MD and FA values in the midbrain, the AUC could be increased to 0.83 (95% CI 0.71-0.96)- 0.89 (95% CI 0.79-0.98).
Conclusion: In the work-up of parkinsonism with uncertain diagnosis, 3 Tesla brain MRI can aid in differentiating between PD and AP which could be improved by quantitative DTI-MRI, but the discriminative power depends on defining imaging criteria.
Author Disclosures:
B. Bloem: Board Member; Editorial Board member of Movement Disorders (earlier), Associate Editor for the Journal of Parkinson's disease (currently), Physiotherapy Canada (currently). Consultant; Boehringer Ingelheim, Danone, Glaxo-Smith-Kline, Solvay. Grant Recipient; Alkemade Keuls fund, Michael J Fox Foundation, Netherlands Organisation of Scientific Research, Prinses Beatrix Foundation, Stichting Internationaal Parkinson Fonds.

B-0595 11:06

Diffusion tensor imaging at 3-T MR for detection of patients with depression and comorbid hypertension in depression

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Purpose: Diffusion tensor imaging (DTI) was used to investigate the differences of white matter impairment between depression and comorbid hypertension in depression. To evaluate the correlation between fractional anisotropy (FA) and degrees of depression.
Methods and Materials: Patients with depression (n=15) and comorbid hypertension in depression (n=27) were compared with age- and sex-matched healthy control subjects (HC, n=26). Voxel-based analysis was used to analyse DTI data (SPM8, DTI studio). FA and mean diffusivity (MD) in patients with depression and comorbid hypertension in depression were compared with HC respectively. The correlation between FA and scores of Hamilton Depression Scale ($HAMD_{17}$) was evaluated.
Results: 1.Compared to HC, FA decreased significantly in patients with depression ($P_{uncorrected} < 0.001$, F=3.18; cluster size > 50) in the right inferior frontal gyrus, right precuneus, right lingual gyrus, left superior temporal gyrus and left cerebellum posterior lobes. 2. More cerebral regions of patients with comorbid hypertension in depression were involved ($P_{uncorrected} < 0.001$, F=3.18),including bilateral superior temporal gyrus, bilateral superior frontal gyrus, bilateral thalamus, bilateral caudate, right parahippocampal gyrus, left middle temporal gyrus, left cerebellum posterior lobes. 3. There were no significant differences in MD. 4. FA in left (r=-0.458) and right superior frontal gyrus (r=-0.474) and right superior temporal gyrus (r=-0.474) were negatively correlated with scores of $HAMD_{17}$ (P=0.001).
Conclusion: Our results reveal underlying extensive white matter impairments in patients with depression. The different patterns of decrease in FA suggest hypertension may play a synergistic action in the progress of depression. FA can reflect degrees of depression and is more sensitive than MD.

B-0596 11:15

Diffusion Kurtosis imaging at 3-T MR imaging for detection of individuals with depression and comorbid hypertension in depression

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Purpose: Diffusion Kurtosis Imaging (DKI) was used to investigate the differences of white matter impairment between depression and comorbid hypertension in depression.
Methods and Materials: We used a voxel-based analysis method to analyse DKI data (SPM8, http://www.fil.ion.ucl.ac.uk/spm/software/spm8; DKE, http://academicdepartments.musc.edu/cbi/dki/DKE) in patients with depression (n=15; 3 males, 12 females) and comorbid hypertension in depression (n=27; 5 males, 22 females) compared with age- and sex-matched no cognitive impairment cases (NCI, n=26; 8 males, 18 females).
Results: Compared to NCI, we found significant decrease in Mean Kurtosis (MK) of patients with depression ($P_{uncorrected} < 0.001$, F=11.6; cluster size > 50) in the right inferior frontal gyrus, bilateral inferior and middle temporal gyrus, bilateral precuneus, midbrain and bilateral cerebellum posterior lobes; Compared to NCI, there are more cerebral regions of individuals with comorbid hypertension in depression involved according to the significant decrease in MK ($P_{corrected} < 0.05$, FWEp=26.52; cluster size > 50), including right inferior frontal gyrus, bilateral superior frontal, bilateral inferior and middle temporal gyrus, bilateral thalami, bilateral limbic lobe uncus, bilateral parahippocampa gyrus, bilateral precuneus, bilateral posterior cingutate and bilateral cerebellum posterior lobes.
Conclusion: Our results revealed underlying extensive white matter impairments in patient with depression. The different patterns of decrease in MK betweendepression and comorbid hypertension in depression suggest hypertension might play a synergistic action in the progress of depression. As a potential biomarker, DKI could differentiate the patients from the healthy.

B-0597 11:24

Validation of an MRI rating scale for amyloid related imaging abnormalities

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Purpose: MRI abnormalities in relation to amyloid-β (Aβ) lowering immunotherapy with edema or effusion (ARIA-E) describes 3 different manifestations, represented as parenchymal hyperintensity, sulcal hyperintensity and gyral swelling. The aim of our study is to validate the use of a recently introduced MRI rating scale for ARIA-E in a larger patient group and multiple raters.
Methods and Materials: We evaluated a group of 75 patients, 30 with known ARIA-E and 45 without and we test the Inter-rater reliability between 5 neuroradiologists using intraclass correlation coefficient. All patients included in this study were part of phase II multicenter, randomised, double blind, placebo-controlled multi ascending dose immunisation study by using Bapineuzumab.
Results: Raters successfully applied the scale with a high agreement in the identification of ARIA-E cases. We observed a high inter-rater agreement for scores of sulcal hyperintensity (ICC= 0.917; 95% CI, 0.86-0.96) and for the combined scores of the 2 ARIA-E findings, parenchymal and sulcal hyperintensity (ICC = 0.881; 95% CI, 0.80 - 0.93). A slightly lower agreement for parenchymal hyperintensity (ICC =0.681; 95% CI, 0.51-0.84) was observed.
Conclusion: There was a very high consensus between the raters to identify the ARIA-E cases and for the scoring for the different ARIA-E findings. This rating scale is a very simple and effective tool to evaluate the severity of this adverse event in patients recruited for Aβ lowering therapeutic trials. It allows accurate monitoring of this adverse event and could aid in dose adjustment.
Author Disclosures:
D. Purcell: Consultant; Consulting Fee or Honorarium Janssen. **H.M. Arrighi:** Employee; Janssen Alzheimer Immunotherapy Research & Development LLC. **F. Barkhof:** Consultant; Consulting Fee or Honorarium Janssen.

B-0598 11:33

The prevalence of cortical superficial siderosis in a memory clinic population

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Purpose: Cortical superficial siderosis (SS) is a recently recognised manifestation of cerebral amyloid angiopathy (CAA). The aim of this study was to determine prevalence, topography and severity of SS in a memory clinic patient cohort and its possible association with Alzheimer's disease (AD).
Methods and Materials: We included 809 patients (56%men, age 66±10 years) from the Amsterdam Dementia Cohort between November 2010 and November 2012 scanned on a 3 Tesla MRI system. We analysed prevalence and topography of cortical SS according to demographic, clinical, and MRI data. Agreement for SS detection between two neuroradiologists was calculated by using Cohen's Kappa.
Results: Agreement for detection of SS was excellent (unweighted κ of 0.81). In 17 patients (2.1%) cortical SS was found without a known cause. The prevalence of idiopathic SS differed according to diagnostic groups ($p < 0.001$): nearly 5% in AD patients (n=168) versus 2% of mild cognitive impairment patients (n=143), and 2.5% of other types of dementia (n=80). By contrast, SS was not found in patients with subjective complaints (n=168) or those with other disorders (n=157). The presence of SS was associated with age, cognition, APOE ε4, microbleeds and white matter hyperintensities (all $p < 0.05$).
Conclusion: The prevalence of cortical SS in a memory clinic setting is higher than reported in the general population, but lower than reported in CAA. The relatively high prevalence of SS in AD and its clinical associations suggest that SS is a relevant radiological manifestation of amyloid pathology in AD. Further longitudinal research is needed to investigate clinical relevance.
Author Disclosures:
M.P. Wattjes: Consultant; Biogen-Idec. Other; lectures for: Biogen Idec, Bayer Healthcare, Roche and Janssen Cilag. **N.D. Prins:** Advisory Board; Boehringer Ingelheim and Envivo. Grant Recipient; Vereniging AEGON. Research/Grant Support; rain Foundation of the Netherlands and Alzheimer Nederland. Speaker; Janssen and Novartis. **P. Scheltens:** Research/Grant Support; GE Healthcare, Danone Research and MERCK (for the istitution). Speaker; Lilly, GE Healthcare, Lundbeck, Danone and Jansen AI-Pfizer (paid to institution). **F. Barkhof:** Consultant; Bayer-Schering Pharma, Sanofi-Aventis, Biogen-Idec, TEVA, Merck-Serono, Novartis, Roche, Synthon BV, Jansen Research. Research/Grant Support; Dutch MS Society and EU-FP7.

B-0599 11:42

Diffusion tensor imaging of the hippocampus and posterior cingulate fasciculus in mild cognitive impairment and early Alzheimer's disease: our initial results

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Purpose: The aim of this study was to show the role of Diffusion Tensor Imaging (DTI) as a potential tool in evaluating microstructural white matter alterations in patients with Mild Cognitive Impairment (MCI) and early Alzheimer's disease (AD).
Methods and Materials: Fifty five subjects (15 MCI; 20 AD; 20 controls) were enrolled. All patients were assessed using physical, neurological and neuropsycological tests. Conventional MRI sequences and DTI were acquired. Fractional anisotropy (FA) and Apparent Diffusion Coefficient (ADC) values were measured using the region of interest (ROIs) method in the bilateral hippocampal body, parahippocampal white matter and posterior cingulate. Data were analysed using Statistical Package For Social Sciences software (ver 21.0; SPSS Inc, Chicago, IL, USA).

Results: In MCI and AD patients we observed a significant FA decrease and ADC increase in the hippocampus, posterior cingulate and parahippocampal white matter compared to controls. Cognitive tests findings showed high correlation with DTI parameters, especially FA values in the hippocampus body and parahippocampal white matter.
Conclusion: Microstructural alterations in the hippocampus, parahippocampal white matter and posterior cingulate were detected by DTI technique in MCI and AD patients. DTI parameters in the hippocampus and parahippocampal white matter could be a potential tool to define microstructural damages in early AD patients and seem to be more correlated with cognitive skills than DTI changes in the posterior cingulate.

B-0600 11:51

Gender and age aspects of hippocampal anatomy in MDD patients compared to healthy volunteers using methods of MR morphometry
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Purpose: Investigation of the hippocampal formation structural variants in patients with major depression disorder (MDD) compared to healthy volunteers.
Methods and Materials: 139 patients in the age from 18 to 50 were examined. The first group of patients consisted of 101 healthy volunteer. The second group included 28 patients with MDD. All of the patients underwent MRI of the brain on 1.5T Toshiba scanner using standard brain protocol with addition of 3D MPRAGE sequence and following voxel morphometry ((FreeSurfer/ Massacyusetts General Hospital - URL.; http://surfer.nmr.harvard.edu).
Results: Different structural variants of hippocampus were found either in healthy volunteers or in patients with MDD. We haven't found significant age correlation of the hippocampal volume of healthy volunteers in the age before 50 years. Hippocampal volume was certainly bigger in men than in women. Early manifestation of MDD and high severity of the disease according to Montgomery-Asberg depression rating scale were found more often in patients with hippocampal structural variants compared to patients with normal architecture of hippocampus.
Conclusion: Morphological variants of the mediobasal parts of temporal lobes couldn't be, as we consider, the direct etiological factor of major depression disorder, but their presence could possibly be the sign of development failure of the brain, and in particular of the brain structures involved in formation of the emotions.

10:30 - 12:00 **Room L/M**

Cardiac

SS 903

Coronary plaques and aorta

Moderators:
A.J.B.S. Madureira; Porto/PT
P. Stolzmann; Zurich/CH

B-0601 10:30

State-of-the-art CT scanners from four different vendors do not substantially affect coronary artery calcium risk classification in a large cohort
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Purpose: Coronary artery calcification (CAC) scores assessed with CT have emerged as an important imaging biomarker for cardiovascular risk classification. American Heart Association guidelines recommend CAC-scoring in asymptomatic adults with low-to-intermediate and intermediate cardiovascular risk, concerning approximately 40% of the United States adult population. Treatment strategies depend on CAC-scores, but state-of-the-art CT-systems from the major vendors have never been compared head-to-head. Our purpose was to determine the inter-vendor variability of CAC-scores ex vivo with state-of-the-art CT-scanners and to assess the effects of this variability on risk-category reclassification in a large population-based cohort.
Methods and Materials: We evaluated the differences in CAC-scores between CT-scanners from four different vendors. Fifteen ex vivo human hearts were placed in a phantom resembling an average human adult. Hearts were scanned at equal radiation dose settings for each vendor. CAC-scores were quantified with clinically used semi-automatic software. The ex vivo CAC-scores were used to simulate the effects of different CT-scanners on reclassification of 432 older individuals from a population-based study at intermediate cardiovascular risk based on Framingham risk scores.
Results: CAC-scores differed substantially between CT-scanners with median CAC-scores ranging from 332 (quartiles 114-1135) to 469 (quartiles 183-1381) between vendors ($P < 0.05$). Simulation showed that these differences resulted in cardiovascular risk-classification shifts in 0.5 to 6.5% of individuals at intermediate risk by using a CT-scanner from a different vendor.
Conclusion: Among individuals at intermediate cardiovascular risk, state-of-the-art CT-scanners produce substantially different CAC-scores, which can result in reclassification to high or low risk in up to 6.5% depending on the vendor.

B-0602 10:39

Phase-contrast computed tomography: coronary plaque characterisation by quantitative phase-contrast Hounsfield units
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Purpose: Poor contrast in low-absorbing materials limits accurate atherosclerotic plaque characterisation by absorption-contrast computed tomography (ACT). Phase-contrast CT (PCT) is an experimental technique relying on X-ray phase-shift, yielding a higher contrast in biological soft tissue. Phase-contrast Hounsfield units (HU-P) can be calculated using the refraction index. We hypothesised that plaque components including fibrous (Fib), lipid-rich (Lip) and calcified tissue (Cal) can be differentiated based on HU-P.
Methods and Materials: Fifteen human coronary arteries were imaged at a laboratory-based set-up using a conventional X-ray tube (35 kV) and grating-interferometer. Tomographic images were reconstructed with a resolution of 100 µm and correlated with histopathology. In both ACT- and PCT-data, regions corresponding to Fib, Lip or Cal based on histopathology were manually traced. Mean HU-A, HU-P and signal-to-noise ratios (SNR) were calculated for analysed regions.
Results: A total number of 316 cross-sections with 184 Fib, 56 Lip and 119 Cal containing regions were assessed. Fib, Lip and Cal were associated with significant different mean HU-P (61.7±18.5, 39.9±16.1 and 447.3±155.5; p=0.00013) and HU-A (76.4±30.6, 41.5±97.5 and 4305.2±1276.6; p=0.0017). However, we observed a substantial overlap in HU-A between Fib and Lip, while there was little overlap in HU-P. The receiver operating characteristic curve showed a significant higher area under the curve for HU-P (0.92) than HU-A (0.85). PCT was associated with an improved SNR in both Fib and Lip (p=0.0024).
Conclusion: PCT can reliably differentiate important components of atherosclerotic lesions based on quantitative HU-P, indicating its high potential for improved assessment of coronary artery disease.

B-0603 10:48

Interobserver agreement of the quantitative computed tomography assessment of high-risk coronary plaque features in the ROMICAT II trial
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Purpose: Excellent reproducibility for CCTA plaque measurements is a prerequisite for quantitative plaque assessment in clinical practice and research trials. We explored interobserver variability of plaque measurements in the ROMICAT II trial.
Methods and Materials: Two readers independently evaluated 30 randomly selected CCTA exams from 473 patients enrolled in the ROMICAT II study. Each reader performed a qualitative assessment for the presence of calcified, non-calcified plaque and the napkin-ring sign (plaque with low CT attenuation surrounded by rim like higher CT attenuation). All plaques were assessed quantitatively using dedicated software (QAngio CT, MEDIS, Leiden, The Netherlands). For each plaque proximal, distal normal reference, minimal luminal area, remodelling index, plaque volume, % plaque burden, low attenuation plaque volume (< 30 HU), and non-calcified plaque volume (< 130 HU) was determined. Kappa statistics was calculated to assess interobserver agreement for binary variables and Pearson's linear correlation coefficient continuous variables.
Results: Interobserver agreement was excellent for all measures. Kappa values were 1.00 for the presence of the napkin-ring sign, 0.73 for the presence of positive remodelling, 0.83 for the presence of low HU plaque, and 0.84 for the presence of plaque burden > 70%. We observed excellent correlation for plaque burden (R=0.94, mean difference 0±6%), minimal luminal area (R=0.98, mean difference 0.1±0.8 mm2), total plaque volume (1.1±5.7 mm3), non-calcified plaque volume (0.7±5.4 mm3), and low HU plaque volume (0.2±1.9 mm3).
Conclusion: Advanced quantitative CCTA assessment of coronary atherosclerotic plaque including high-risk plaque features can be performed highly reproducible in a multicenter multivendor setting of the ROMICAT II trial.

Author Disclosures:
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B-0604 10:57

Can we evaluate the effect of genetic and environmental influences on coronary anatomy and plaque characteristics? initial experience with coronary CT angiography in twin pairs

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Purpose: Twin studies provide a unique method for assessing the phenotypic impacts of environmental and genetic factors through the comparison of monozygotic (MZ) and dizygotic (DZ) twins. The heritability of coronary anatomy, which may influence plaque formation through local haemodynamic effects, and the heritability of plaque morphology were not yet studied. We sought to assess these parameters. Here, we report our initial experience.
Methods and Materials: In this classical twin study we plan to enroll 100 asymptomatic, adult twin pairs with no history of coronary artery disease. The %plaque burden, plaque volume and non-calcified plaque volume were assessed by coronary CT angiography (Philips 256-slice iCT, Best, The Netherlands). Plaque analysis was perfomed with a dedicated software (QAngio CT Research Edition, Medis B.V., Leiden, The Netherlands).
Results: At this point, 30 twins (mean age 57±9 years, 22% male), 6 MZ and 9 DZ pairs, were enrolled. Dyslipidemia was present in 57%, hypertension in 27%, diabetes in 10% of the twins and 33% of the twins were smokers. Coronary atherosclerosis was present in 12 subjects and 56 plaques were detected. We observed a median total plaque burden of 40.3 (IQR:34.7-45.9)%; plaque volume of 39.6 (IQR:24.9-82.9) mm3 and a non-calcified plaque volume of 15.4 (IQR:8.6-30.2) mm3.
Conclusion: Our first impression is that CCTA of twins provides a valuable tool to assess heritability of coronary geometry and coronary plaque morphology. To perform statistically robust analysis, the enrollment of 100 twin pairs is warranted. The target completion date of the study is March 2014.
Author Disclosures:
P. Maurovich-Horvat: Research/Grant Support; "Nemzeti Kivalosagi Program" TAMOP 4.2.4.A/1-11-1-2012- 0001

B-0605 11:06

Computed tomography characteristics of coronary artery atherosclerosis in subjects with lower extremity peripheral artery disease and no cardiac symptoms

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Purpose: Computed tomography coronary angiography (CTCA) enables non-invasive evaluation of coronary artery atherosclerosis. However, its value to assess coronary artery disease (CAD) in subjects with lower extremity peripheral artery disease (PAD) and no cardiac symptoms is unknown. The objectives are to determine the value of CTCA to assess coronary artery atherosclerosis and to evaluate the relationship between coronary artery plaque characteristics and severity of peripheral atherosclerosis in subjects with lower extremity PAD and no cardiac symptoms.
Methods and Materials: Sixty-five individuals (45 males, 20 females, mean age 62.5±7.6 years) with lower extremity PAD and no cardiac symptoms underwent CTCA.
Results: CTCA revealed CAD in 56 subjects. Twenty-two had obstructive CAD. The mean ankle-brachial index (ABI) was 0.64±0.16. Twenty-six individuals demonstrated abnormal carotid artery intima-media thickness (IMT). ABI<median, if compared to ABI≥median was associated with higher proportion of obstructive multivessel to single vessel CAD (8:4 versus 1:9;p=0.01) and higher number of coronary artery segments with mixed plaques (2.3±2.2 versus 1.2±1.3;p=0.02). Comparing patients with abnormal and normal IMT, the former demonstrated higher proportion of obstructive multivessel to single vessel CAD (7:3 versus 2:10;p=0.01) and higher number of coronary artery segments with non-calcified (1.9±3.2 versus 0.6±1.4;p=0.04) and mixed plaques (2.3±2.1 versus 1.3±1.7;p=0.049).
Conclusion: CTCA may be effective to detect CAD in subjects with lower extremity PAD and no cardiac symptoms. The low ABI and abnormal IMT are associated with more extensive CAD and higher burden of high-risk coronary artery plaques.

B-0606 11:15

Iterative reconstruction algorithms in coronary CT angiography for the characterisation of coronary atherosclerotic plaque: a comparison with histology

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Purpose: To evaluate whether iterative reconstruction algorithms improve the accuracy of coronary CT angiography (CCTA) for coronary plaque characterisation compared to histology.
Methods and Materials: CCTA and histological data were acquired from the coronary arteries of 3 ex-vivo hearts. CT images were reconstructed by using filtered-back projection (FBPR) as well as adaptive-statistical (ASIR) and model-based (MBIR) iterative reconstruction algorithms. Cross-sectional images were co-registered between CCTA and histology and a semi-automated plaque assessment was performed for each reconstruction algorithm. The results were then compared to histology.
Results: Of 173 included cross-sections, presence of a lipid-core plaque (LCP) was in 26 cross-sections based on histology. Plaque area < 60 HU was larger in cross-sections with LCP as compared to non-LCP (mean plaque area < 60 HU in FBPR 5.17vs.3.16,p < 0.0001;in ASIR 5.58vs.3.16,p < 0.0001;in MBIR6.49 vs.3.23,p < 0.0001, respectively). This translated into an area under the curve (AUC) for detecting LCP by CTA of 0.803 for FBPR, 0.850 for ASIR, 0.903 for MBIR. The AUC of MBIR was significant higher as for FBPR (p=0.01). In cross-sections with any calcification by histology, the plaque area > 180 HU in CCTA increased with increasing size of calcification in histology. As compared to FBPR and ASIR, a reduced plaque area > 180 HU was observed for MBIR (p=0.03 and 0.008,respectively).
Conclusion: Plaque area < 60 HU in CCTA was associated with LCP regardless of the reconstruction algorithm. However, MBIR demosntrated a higher accuracy for LCP and degreased potential blooming of calcification compared to ASIR and FBPR. This may improve the value of CCTA for patient risk stratification.

B-0607 11:24

Distensibility of the ascending and descending aorta in patients with aortic stenosis

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Purpose: Patients with bicuspid valve disease and aortic stenosis commonly develop aortic dilatation that may relate to an associated aortopathy or mechanical stress. We sought to demonstrate whether these patients had altered aortic distensibility compared to those with a trileaflet valve and subjects without stenosis.
Methods and Materials: We recruited 95 subjects (age 63±9 years) with different aortic valve morphologies (23 bicuspid (BAV), 50 tricuspid (TAV) and 21 non-stenotic). Distensibility on both ascending and descending aorta was measured on MRI as the change in cross-sectional aortic area per unit change in blood pressure.
Results: Significant difference in distensibility is demonstrated between ascending and descending aorta in both the stenotic groups (P < 0.05), which is not seen in non-stenotic patients (≥ 0.05). Moreover, patients with BAV have higher mean distensibility compared to patients with TAV although it was not statistically different. The mean distensibility ($mmHg^{-1}$) in the stenotic bicuspid group of the ascending aorta was $3.39\pm1.9 \times 10^{-3}$ and of the descending $5.71\pm2.9 \times 10^{-3}$. For the stenotic tricuspid group values were $2.6\pm1.2 \times 10^{-3}$ in the ascending and $4.16\pm2.3 \times 10^{-3}$ in the descending. The distensibility in controls were 6.19±6.3 and 6.32±3.47, respectively. No association was found between the severity of aortic stenosis and distensibility.
Conclusion: The study shows that there is a significant impact on the distensibility ratio, of ascending to descending aorta, in patients suffering from aortic stenosis.

B-0608 11:33

Evaluation of aortic valve calcium and feasibility of transcatheter aortic valve implantation with first- and second-generation transcatheter heart valves

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Purpose: With the recent availability of several second-generation transcatheter aortic valve implantation (TAVI) devices, a correlation between aortic valve calcium load and paravalvular regurgitation remains to be investigated. We performed a retrospective CT based assessment of aortic valve calcium in correlation with hemodynamic performance of different transcatheter heart valves.

Methods and Materials: In 156 patients preoperative contrast-enhanced CT scans with prospective ECG gating were available for retrospective analysis. Three-dimensional reconstruction of CT data was performed using the 3Mensio software (3Mensio Medical Imaging, Bilthoven). After calibration for contrast agent density, calcium load was quantified within the device-landing zone. Data were correlated with echocardiographic measurements.
Results: Total aortic valve calcium was 2468±1685 mm3 with eccentric distribution (> 50% of calcium load at one cusp) in 26.3% and calcium protruding into the left ventricular outflow tract in 41.7% of patients. Devices implanted were the Edwards Sapien XT (n=52), Medtronic CoreValve (n=33), Symetis Acurate (n=25), JenaValve (n=20), and Medtronic Engager (n=26) valves. Postprocedural paravalvular regurgitation was none or trace in 65.2% and mild in 34.8%. Although a trend towards a correlation of calcium load and paravalvular regurgitation was observed (p=0.054), no differences in hemodynamic performance with regard to different valve types and aortic valve calcium could be demonstrated.
Conclusion: TAVI using first- and second-generation devices can be performed with good hemodynamic results, irrespective of annular calcification. Aortic valve calcium seemed to be associated with increased paravalvular regurgitation, however no relevant predictors of regurgitation for the different transcatheter heart valve prostheses could be identified.

B-0609 11:42

Transcatheter aortic valve implantation (TAVI) for severe aortic stenosis: the significance of non-vascular incidental pathology at CT angiography and the impact on outcome

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Purpose: Untreated severe aortic stenosis (AS) has poor prognosis and is common amongst older patients with comorbidity who are at high risk for definitive aortic valve replacement. TAVI is a less invasive alternative but approximately 33% may have iliofemoral atherosclerosis precluding TAVI. The burden of incidental non-vascular pathology (INVP) in pre-TAVI patients has not been quantified before.
Methods and Materials: We reviewed 100 consecutive pre-TAVI CT angiography (CTA) scans. All CTAs were reported by Consultant Cardiovascular Radiologists. The radiological reports were reviewed for the documentation of INVP which were stratified by clinical relevance. The presence of INVP in those managed conservatively was compared to those who underwent TAVI.
Results: INVP was documented in 88%, consisting of unsuspected possible malignancy in 8%, progression of known malignancy in 1%, conditions requiring acute treatment in 17% (e.g. pulmonary oedema) and indeterminate findings present in 19% (e.g. lung nodules). However, no INVP was anticipated to have worse prognosis than severe AS. Of the 100 pre-TAVI patients who underwent CTA, 40% proceeded to TAVI. A trend towards more incidental findings requiring acute treatment was seen in conservatively managed patients (30% vs 60.5%, P = 0.15). Emphysema was present in significantly more conservatively managed patients compared to TAVI patients (18.4% vs 0%, P < 0.05).
Conclusion: INVP in patients undergoing CTA prior to TAVI are common and potentially clinically relevant. Less than 50% referred for CT (aorta) pre-TAVI actually underwent TAVI. The presence of emphysema on pre-TAVI CTA may be a potential predictor of subsequent conservative management.

B-0610 11:51

CT-angiography of the aortic annulus for prosthesis sizing in TAVI: comparison of predictive values of major anatomic parameters

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Purpose: To compare the predictive value of CT-derived annulus measurements prior to transcatheter aortic valve implantation (TAVI) for the selection of prosthesis size for two major valve models.
Methods and Materials: In 351 TAVI-patients (235: CoreValve, 116 Edwards Sapien), optimal prosthesis size was determined during the TAVI procedure by inflation of a balloon catheter at the aortic annulus. All patients had previously undergone CTA of the bodytrunk at our institution. Two readers independently determined long and short axis as well as circumference and area of the aortic annulus. A nested cross-validation approach was used to estimate the predictive power of these parameters for the prosthesis size ultimately implanted and to define optimal cut-off values.
Results: There was excellent agreement between observers for the major anatomic parameters (ICC's> 0.85). Differences between patients who underwent implantation of the small, medium or large prosthesis were significant for all evaluated parameters and both valve models (p's< 0.05). Annulus area and circumference had equally high predictive power for prosthesis size (multi-class AUC's: 0.86, 0.87, 0.87, 0.88). Application of the optimal cut-off values for annulus circumference suggested by our cross-validation strategy (CV:7.7;8.9 cm; ES:7.2;8.8 cm) would have resulted in the selection of the size ultimately considered optimal in 87%(306/351) of cases.
Conclusion: CT-based annulus measurements permit good prediction of the prosthesis size considered optimal during TAVI. Applying the calculated cutoff values, identical prosthesis size would been selected in 87% of cases on the basis of CT alone. Extending our model to the degree of calcification might further increase its predictive power.

10:30 - 12:00 **Conf. Room M3**

Interventional Radiology

SS 909

Aortic and neuro interventions

Moderators:
R.F. Dondelinger; Liege/BE
D. Filippiadis; Athens/GR

B-0611 10:30

Endovascular aneurysm repair (EVAR): is imaging surveillance robust and does it influence long-term mortality?

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Purpose: EVAR is the dominant treatment strategy for abdominal aortic aneurysms. However, due to uncertainty regarding long-term durability an on-going imaging surveillance programme is required. The aim was to assess the deliverability and its effect on all-cause and aneurysm-related mortality.
Methods and Materials: A retrospective analysis of all EVAR procedures carried out in the four main Scottish Vascular Units. Patients were identified locally and imaging data collected by manually searching a combination of different databases. Complete imaging follow-up was defined as following the local protocol for each site and subsequent continuing annual imaging. Outcome measures included all-cause and aneurysm-related mortality. Cause of death was obtained from the death certificate.
Results: Data were available for 569 patients from 2001 to 2012. All centres had data for a minimum of 5 contiguous years. Follow-up period ranged from 1.66 to 4.55 years (median 3.03). Overall 53% had complete imaging surveillance, 43% partial and 7% none. For the whole cohort all-cause 5-year mortality was 33.5% and aneurysm-related mortality was 4.5%. All-cause mortality in patients with complete, partial and no imaging was 49.9%,19.1% and 47.2% and aneurysm-related mortality was 3.7%, 4.4% and 9.5%, respectively. All-cause mortality was significant higher in patients with complete imaging surveillance (p < 0.001). No significant differences were observed in aneurysm related mortality (p=0.2).
Conclusion: Only half of EVAR patients achieve complete long-term imaging surveillance over a minimum 5-year period. However, incomplete imaging could not be linked to any increase in mortality. This information may have implications for the national screening programme.

B-0612 10:39

CTA with fluoroscopy image fusion guidance in endovascular complex aortic aneurysm repair

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Purpose: To evaluate the application and benefit of intraoperative guidance by means of live fluoroscopy image fusion with computed tomography angiography (CTA) in endovascular thoraco-abdominal aortic repair.
Methods and Materials: CTA with fluoroscopy image fusion road-mapping was prospectively evaluated in patients with thoraco-abdominal aortic aneurysms who underwent fenestrated and/or branched endovascular repair (FEVAR/BEVAR). C-arm cone beam computed tomography (CBCT) was performed prior to the interventions and manually co-registered to patients' outpatient diagnostic CTA dataset. Radiation dose of CBCT in terms of dose area product (DAP, in $mGym^2$) was registered. Total procedural iodinated contrast material dose, overall procedure time and fluoroscopy time were compared between the fusion group (n=31) and case controls (n=31).
Results: Radiation dose of CBCT was 1.47 ± 0.41 $mGym^2$ (mean±SD). Image co-registration was feasible in all patients within approximately five minutes. Fusion image road-mapping was used for navigation and positioning of the devices and catheter guidance during access to target vessels. Iodinated contrast material dose and procedure time were significantly lower in the fusion group compared to case controls (159 cc (95% CI: 132 cc; 186 cc) versus 199 cc (95% CI: 170 cc; 229 cc), p=0.037 and 5.2 hours (95% CI: 4.5 h; 5.9 h) versus 6.3 hours (95% CI: 5.4 h; 7.2 h), p=0.022). No significant differences in fluoroscopy time were observed.

Conclusion: Image fusion guidance is a valuable addition in complex endovascular interventions. The technology supports accurate target vessel canalisation and stentgraft placement. It contributes to reduce iodinated contrast material dose and procedure time.

B-0613 10:48

A 10-year retrospective review of pelvic ischaemic complications due to internal iliac artery embolisation prior to EVAR

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Purpose: Internal iliac artery (IIA) embolisation is frequently performed prior to endovascular aortic aneurysm repair (EVAR) when concomitant common illiac aneurysms necessitate graft extension into the external iliac arteries (to prevent endoleaks via retrograde IIA flow). Because the safety of this procedure remains questionable, we aimed to determine the incidence of associated pelvic ischaemic complications, and to establish what parameters are predictive of increased patient risk.
Methods and Materials: A retrospective review of clinical records and pre-procedural CT angiography was conducted for all patients undergoing IIA embolisation prior to EVAR from 2002 to 2012. Bivariate analysis (Spearman correlation tests: $p < 0.05$ significant) was used to test for differences between two groups, those with or without new-onset pelvic ischaemic complications during follow-up.
Results: Twenty-five patients underwent elective IIA embolisation average 23 days prior to EVAR (average age 72.2; 22/25 male). 3/25 patients underwent bilateral embolisation, 22 unilateral. Overall, 7/25 patients (28%) experienced new-onset pelvic ischaemic complications, including erectile dysfunction (1/25), bilateral leg paraesthesia (1/25), and buttock claudication (BC) (5/25). Long-term persistence of BC could be confirmed definitively in only 2 of the 5 patients. A shorter time interval from embolisation to EVAR correlated statistically with increased risk of pelvic ischaemic complications ($p < 0.03$). Bilateral IIA embolisation was independently associated with BC ($p < 0.032$). No patient risk factors or CT angiographic factors were predictive of increased risk.
Conclusion: We conclude that by avoiding both a short-time interval from embolisation to EVAR, and bilateral IIA embolisation, the risk of persistent ischaemic complications due to IIA embolisation can be significantly minimised.

B-0614 10:57

Outcomes of endovascular treatment for aortic pseudoaneurysm in Behcet's disease

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Purpose: To evaluate the effectiveness of endovascular stent-grafting for surgical management of aortic pseudoaneurysm in patients with Behcet's disease (BD).
Methods and Materials: We present a single-institution retrospective cohort of patients with aortic pseudoaneurysm and BD treated with aortic stent-grafting. CT imaging was obtained preoperatively in all patients and once within two weeks postoperatively, and then annually. Clinical follow-up and erythrocyte sedimentation rate (ESR) were used to follow BD activity. Immunosuppressant therapy was instituted prior to endovascular treatment unless a contraindication existed.
Results: From 1998 to 2012, 10 patients (eight male, two female; median age 39) with BD and aortic pseudoaneurysm were treated with endovascular stent-grafting at this institution. 90% of these patients received immunosuppressive therapy before and after surgical treatment. The median follow-up period was 57 months (interquartile range, IQR 43-72). The locations of the 12 pseudoaneurysms treated in this cohort were infrarenal abdominal aorta (seven), descending thoracic aorta (four), and aortic arch (one). Median pseudoaneurysm size was 4.5 cm (IQR 3.4-5.9). At long-term follow-up, complete resolution of the aortic pseudoaneurysm was noted in all patients. No endoleaks occurred. Newly developed pseudoaneurysm at the distal margin of the stent-graft was noted in one patient 17 months after the stent-graft procedure. One patient required a subsequent stent-graft placement for an expanding pseudoaneurysm of the subclavian artery. No patient deaths occurred during the follow-up period.
Conclusion: Endovascular treatment of aortic pseudoaneurysm with stent-grafting in patients with BD is safe and effective with long-term durability.

B-0615 11:06

Accurate fluoroscopy-guided fenestration of aortic dissections using a conventional reentry catheter: first clinical experiences

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Purpose: Evaluation of the feasibility and effectiveness of fluoroscopy-guided needle insertion for gaining controlled target lumen reentry in fenestration of aortic dissections.

Methods and Materials: Between 2009 and 2013, eleven consecutive patients (10 male patients, mean age 51 ± 14 years) with malperfusion syndrome from aortic dissection (8 type B and 3 type A dissections) were treated using the Outback LTD reentry catheter (Cordis, Miami Lakes, Florida). This 6-F catheter is equipped with a curved, extendable coaxial needle that allows accurate real-time fluoroscopy-guided puncture of the target lumen. After successful reentry a 0.014" guidewire may be directed through the coaxial needle into the target lumen. Patients had developed renal (n=6), mesenterial (n=1), spinal (n=3) and iliofemoral (n=7) ischemia. Three patients underwent stentgraft implantation prior to fenestration. Technical success, total procedure time, clinical outcome, follow-up imaging (CTA and MRA including flow measurements) and complications were evaluated.
Results: The technical success rate using this reentry catheter was 100%. Total procedure time was 72 ± 30 minutes; range 32 - 139 minutes. 3 patients with iliofemoral malperfusion syndrome required additional stent implantation. In all patients a significant improvement of clinical symptoms occurred. Follow-up imaging (mean follow-up period 164 days) showed a stable dissection membrane. One patient with spinal malperfusion died due to his bad general condition during hospitalisation.
Conclusion: This conventional fluoroscopic-based reentry catheter is a reliable and safe tool for gaining controlled target lumen reentry in fenestration of aortic dissections with malperfusion syndrome.

B-0616 11:15

Uncovered stent implantation in complicated acute aortic dissection type B

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Purpose: To retrospectively evaluate the technical feasibility and mid-term results of uncovered thoraco-abdominal bare metal stent placement in complicated acute aortic dissection Stanford type B (AADB).
Methods and Materials: Fourteen patients (3 female, range 44-71 years) with AADB suffering from apparent gastrointestinal malperfusion and claudication underwent uncovered metal stent implantation (diameter 7-28 mm, length 40-100 mm) into the thoraco-abdominal aorta (n=23) and visceral arteries (n=5).
Results: Stenting yielded considerable clinical improvement in 13 of 14 patients. More than one stent (up to four) was placed in seven patients (2 celiac, 1 mesenteric, 2 renal, 8 aorto-iliac). Follow-up CTA revealed collapse of four aortic stents (diameter 9-25 mm, length 100 mm) after one week. Catheterisation and balloon dilatation of all four stents were possible, but re-collapse occurred 1 month later in all cases. However, patients were asymptomatic; ultrasound and CTA showed sufficient perfusion of the visceral arteries in all patients. Follow-up ranged from 6 months to 5 years (average 2.5 years). One patient required an iliaco-mesenteric bypass for treatment of chronic mesenteric ischaemia, one month after stent placement. No other patient required additional interventional or surgical therapy.
Conclusion: Thoraco-abdominal stent placement is a technically feasible minimally invasive therapy in complicated AADB yielding similar clinical results compared to treatment by dedicated covered aortic stentgraft. Stent size should be below the normal aortic diameter to avoid possible stent collapse.

B-0617 11:24

Feasibility of the superselective test with propofol for determining eloquent brain regions in the endovascular treatment of arteriovenous malformations

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Purpose: The superselective test for determining eloquent brain areas, carried out prior to the embolisation treatment for AVMs, is a tool contributing to increase the safety of endovascular procedures. Taking into account amobarbital unavailability, it was decided to carry out the present study, aimed at demonstrating propofol's efficacy and safety as an alternative to the use of amobarbital to perform this test.
Methods and Materials: A group of 58 patients that went through 91 embolisation sessions were treated for brain AVMs using endovascular surgery between February 2006 and February 2011. The superselective test was performed prior to embolisation with Histoacryl, using the intra-arterial administration of 20 mg of propofol through a microcatheter positioned near the AVM nidus.
Results: 10 (7.8%) of the 128 superselective tests turned out positive. Neurological deficits appeared immediately after propofol administration, lasted for a minute and disappeared after 5 minutes. Only one of the patients showing a negative test result developed neurological deficits after embolisation, for 99.2% NPV. Despite their positive test results, six patients were embolised and five developed postembolisation neurological deficits, for 83.3% PPV. The test showed 83.3% sensitivity and 99.2% specificity.
Conclusion: The use of propofol to perform the superselective test during brain AVM embolisation is a safe and effective alternative to the use of amobarbital, and may predict the occurrence of post - embolisation ischemic complications.

B-0618 11:33

Mechanical thrombectomies performed in acute ischaemic stroke patients in Paula Stradins Clinical University hospital during 2010. - 2013

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Purpose: Evaluate safety and efficacy of endovascular thrombectomy as a treatment method of acute ischaemic stroke during large artery occlusion.
Methods and Materials: This was a retrospective study of 96 patients with acute ischemic stroke hospitalised in Paula Stradins Clinical University hospital from 28.12.2010 till 01.08.2013 and treated by endovascular thrombectomies due to large artery occlusions. Telephone interviews were performed 3 months after thrombectomy using modified Rankin Scale (mRS). Paired samples T-test was used.
Results: There were 50 (52.1%) males and 46 (47.9%) females, mean age was 67.13±10.22 (SD) years.The majority of thrombs were localised in anterior circulation area - 77 (80.20%), in posterior circulation area - 19 (19.8%). Mean time from stroke's onset to mechanical thrombectomy was 252.28±97.71 (SD) min in anterior circulation area and 417.90±170.59 (SD) in posterior circulation area.Mean National Institutes of Health Stroke Scale (NIHSS) until thrombectomy was 16.58±6.51 (SD), mean NIHSS after was 8.91±7.80 (SD). The difference was statistically significant, $p < 0.0001$.MRS before thrombectomy - mRS 3 got 1 (1.0%) patient with mild disability, mRS 4-5 got 95 (99.0%) patients with moderately severe and severe disability. At 3 months after, 37 (38.5%) patients had good outcome mRS-2 and less, 19 (19.8%) patients had mild disability, 9 (9.4%) patients had severe disability, mRS 4-5. There are no data about 9 (9.4%) patients. Total mortality after 3 months was 22 (22.9%)-mRS 6.
Conclusion: Mechanical thrombectomy can significantly improve neurological outcomes in patients with severe ischaemic stroke. Accurate patients' selection improved the late neurological results compared to our previous study.

B-0619 11:42

Transcatheter embolisation of extracranial aneurysms using n-butyl cyanoacrylate

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Purpose: To clarify the efficacy of transcatheter embolisation using n-butyl cyanoacrylate (NBCA) for extracranial aneurysms.
Methods and Materials: For 18aneurysms (5splenic, 5internal iliac, 3hepatic arteries, 1celiac, 1 gastroduodenal, 1renal, 1uterine artery, 1thoracic aorta) in 17 patients, embolisation using NBCA with Lipiodol (33-67%) was performed. The etiology includes atherosclerosis (10), pseudoaneurysm (3), myocosis (3), and median arcuate ligament compression (2). In 13aneurysms, coils were used as frames or nests for subsequent glue injection. Flow control using a balloon catheter was applied in 5aneurysms and distal neck was embolised by coils in 5aneurysms to prevent glue migration. The coil and glue packing densities for the aneurysmal volumes were calculated.
Results: For 8.2±9.9 mL of aneurysm volumes, 1.9±2.0 mL of NBCA was injected after framing by 0.2±0.2 mL of coil volumes; the coil packing density was only 3.8±4.3%. In 2splenic aneurysms, glue was migrated to splenic parenchyma intentionally as partial splenic embolisation. In other two internal iliac artery aneurysms, minor distal migration was observed without clinical sequels. Incomplete occlusion occurred in one aneurysm due to shortness of glue and recurrence occurred in two mycotic aneurysms. NBCA expanded 4.4±3.9 times in the aneurysms.
Conclusion: Transcatheter embolisation using NBCA was useful in reducing coil usage with a high success rate.

B-0620 11:51

Endovascular stenting of extra-cranial internal carotid artery or vertebral artery occlusions in the management of acute stroke

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Purpose: Middle cerebral artery (MCA) embolic occlusion with concomitant cervical internal carotid artery (ICA) occlusion is associated with a low rate of recanalisation and poor outcome after intravenous thrombolysis. The purpose of this study was to assess outcome of endovascular stenting of extra-cranial internal carotid artery or vertebral artery tandem occlusions using NIHSS, modified Rankin score (mRS) and thrombolysis in cerebral infarction (TICI) scores.
Methods and Materials: Retrospective analysis of our stroke thrombectomy database identified 124 patients. In addition to mechanical thrombectomy, 15 patients underwent ICA stenting for tandem ICA/MCA occlusions and 3 patients had vertebral origin stenting for VA origin/basilar artery occlusions. We examined neurological improvement defined by ≥ 10-point reduction of NIHSS score, TICI and improved mRS = 2 & 3 score at 90 day.
Results: 90-day follow-up data was available for 18 patients which showed 47%(n=7) had a reduction in the NIHSS score by greater than 10 points and a mRS ≤ 2 at 90 days. 67%(n=10) had a good outcome with a mRS of either 2or3. 87%(n=13) achieved TICI 2b or 3 signifying successful recanalisation. Mortality was 26 %(n=4) with 3 deaths due to malignant MCA infarction and 1 death due to pneumonia.
Conclusion: There was significant improvement in NIHSS, mRS and TICI scores in our 18 patients who underwent endovascular stenting for extra-cranial internal carotid artery or vertebral artery tandem occlusions. Major Strokes due to ICA and VA origin/basilar occlusions can be successfully treated by ICA/VA origin endovascular stenting in conjunction with mechanical thrombectomy.

10:30 - 12:00 **Board Room A**

Radiographers

SS 914

Optimisation of dose and image quality in CT

Moderators:
E. Agadakos; Athens/GR
J. Cabukovska-Radulovska; Skopje/MK

B-0621 10:30

Optimisation of paediatric head computed tomography examinations: an experimental and clinical approach

J. Santos[1], S. Foley[2], G. Paulo[1], M. McEntee[3], L.A. Rainford[1]; [1]*Coimbra/PT*, [2]*Dublin/IE*, [3]*Sydney/AU (joanasantos@estescoimbra.pt)*

Purpose: Optimisation of paediatric head Computed Tomography (CT) examinations.
Methods and Materials: Preset protocols for head CT examinations, derived from three national Portuguese paediatric centres were applied to Catphan 600 and anthropomorphic phantoms (0, 5 and 10 years old). Current exposure parameters were manipulated to optimise radiation dose. OsiriX software based on standard deviation pixel values was applied to measure image noise. CT scanner dose reports provided CT Dose Index (CTDIvol-mGy) and Dose Length Product (DLP-mGy.cm). The findings were discussed locally with the participating centres. Based on the results a CT system upgrade with tube current and voltage modulation proceeded in one centre. Patient data pre/post upgrade was collated to review dose and image quality levels. Patient images were presented in Viewdex software underwent Visual Grading Characteristic (VGC) image quality evaluation by paediatric neuro-radiologists (n=4), using anatomical criteria scoring.
Results: Optimisation across participating centres resulted in dose reductions of between 13% and 65%. Post experimental optimisation similar image noise levels to the preset were identified. The CT upgrade demonstrated a decrease in mean dose for head CT examinations of 42%, image quality evaluation is on-going and will be presented.
Conclusion: Minor exposure parameter manipulations facilitated paediatric CT dose reduction with limited impact on image quality. The optimisation tests and the system software upgrade promoted a dose reduction in children.

B-0622 10:39

Low-dose chest CT vs bedside chest x-ray in emergency patients

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Purpose: In this prospective non-randomised study, the diagnostic yield of bedside chest X-ray (bCXR) with non-contrast-enhanced low-dose chest computerised tomography (LDCT) was compared.
Methods and Materials: 16 subjects > 65 years planned for bCXR underwent LDCT immediately afterwards. bCXR was performed with AP (150 KV and 2.5 mAs) and lateral (140 KV and 6 mAs) views, mean radiation dose of 0.7 mSv and LDCT (average radiation dose = 0.59 mSv). Each bCXR and LDCT examinations were read on different occasions by three blinded radiologists independently. The degree of general diagnostic confidence was scored (1-4). The agreement between the results was assessed by intraclass correlation coefficient, and Cohen's and weighted kappa.
Results: The average confidence score was always higher or the same for LDCT compared to bCXR (mean 2.85 for reading bCXR and 3.83 for LDCT). There was no discrepancy for diagnosis of pneumothorax on LDCT. On bCXR however, there were two false negative and two false positive cases. Objective measurements of atelectasis depth (ICC 0.64 vs. 0.36), depth of pleural effusion (0.74 vs. 0.27) and heart size dimension (0.82 vs. 0.43) always showed better agreement on LDCT readings than bCXR readings, respectively. The following were missed on bCXR: four pulmonary opacities, three malignancies, two patients with free intra-abdominal air and one case of fracture. No extra finding was missed on LDCT compared to bCXR.

Conclusion: Chest LDCT with less radiation dose than bCXR discloses more diagnoses and shows higher reliability and reader confidence.

B-0623 10:48

Psychophysical evaluation of CT image quality using human observers and software analysis

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Purpose: Comparison of objective image quality characteristics obtained from human observer evaluations and software analysis of CT phantom images.
Methods and Materials: A Catphan®600 CT quality assurance phantom was scanned using protocols for four anatomical areas: posterior fossa; cerebrum; abdomen and chest on three different CT models as part of an optimisation strategy. CT image data sets (n=24) obtained pre and post-optimisation were blindly evaluated by radiographers (n=8) identifying the number of distinctly discernible line pairs and contrast discs for each of the three supra-slice sets within the phantom's high-resolution and low-contrast modules, respectively. The same CT data sets were also gauged using the web based service - Image Owl for the automatic analysis of Catphan®600 images.
Results: Inter-observer reliability measured using Cronbach's α between human observers and again including software analysis (9th observer) gave α=0.97 for both instances, indicating that internal consistency of the observer group, with and without software analysis was identical.
The results of a paired sample t-test showed no significant difference ($p > 0.05$) between human observers and software analysis in 37.5% of observations for line pairs and 37.5%; 12.5% and 50% for the three sets of contrast discs.
Conclusion: Combined use of human observers and software analysis for evaluation of image quality in CT using phantoms is recommended. However, the sole use of software analysis methods may provide more detail than that obtained by human observers. Further research to measuring the clinical relevance of such image quality findings is recommended.

B-0624 10:57

An investigation into the application of optimised CT protocols for head examinations across clinical centres in Malta and Denmark

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Purpose: To investigate dose and image quality differences between clinically adopted optimised Maltese head CT protocols and preset parameters applied in a Danish center for matched CT equipment.
Methods and Materials: A Danish clinical center with a GE BrightSpeed Elite 16-slice CT scanner was approached to participate in the optimisation study. Head CT protocols were reviewed from the twinned Maltese and Danish centers. Maltese head CT data sets (n=20) produced using previously optimised protocols were collated for image evaluation and combined with non-optimised Danish preset head data sets (n=20). All anonymised images contained minimal abnormal pathology. VIEWDEX software was employed for image display. Controlled ambient lighting of > 60 lux and 3MP primary class monitors were employed. A radiology cohort stated their confidence in the identification of CEC validated anatomical structures. Image quality analysis was performed using Visual Grading Characteristic (VGC) analyses and dose data (CTDIvol and DLP) reviewed for the optimised (Maltese) and preset options (Danish).
Results: Optimised Maltese protocols had been previously found to reduce CTDIvol and DLP by 7.5% and 5.7% respectively when compared to the original manufacturer preset scanning parameters, whilst image quality was maintained. Mean dose values for CT head examinations were noted: Maltese CTDIvol 33.12 mGy / DLP 461.45 mGycm and Danish CTDIvol 71.98 mGy and DLP 1047.26 mGycm.
Conclusion: Optimised head CT protocols demonstrated dose savings of 55% compared to the current preset Danish imaging parameters. The Danish image evaluation is currently on-going and findings will be presented with the completed dose analysis.

B-0625 11:06

Optimisation of the CT kidney ureter bladder protocol

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Purpose: Population radiation exposure due to increased use of CT KUB in renal colic has become significant. Therefore, efforts should be directed to optimise CT scan parameters minimising radiation exposure whilst maintaining diagnostic efficacy.
Methods and Materials: Optimisation of the local protocol on a Philips Brilliance 64 slice CT was performed in stages. Firstly, radiation dose and image quality descriptors were established in a phantom experiment involving systematic reduction of scan parameters on the Philips quality control phantom. Resulting images were visually scored by radiographers (n=10) in terms of spatial and contrast resolution identifying an exposure combination detecting structures ≥2 mm in size, as smaller calculi are clinically insignificant. Secondly, the resulting exposure combination was applied in a clinical trial involving 10 patients. The images produced were compared to a randomly selected retrospective image sample (n=10) acquired with the current protocol. Radiologists (n=5) visually graded the image data sets based on a combination of CEC image quality criteria for CT KUB and the unenhanced abdomen. Image quality data was analysed using visual grading characteristics (VGC) and findings considered significant at the 95% confidence interval.
Results: Mean radiation dose levels in terms of CTDIvol (1.76 mGy) and DLP (95 mGycm) post optimisation were significantly ($p < 0.05$) between images obtained from both protocols.
Conclusion: The optimised protocol was found to have similar diagnostic quality to the current protocol with a significant reduction (70%) in both CTDIvol and DLP.

B-0626 11:15

Preventable exposure in routine chest CT examinations: evaluation of effective dose beyond prescribed anatomical landmarks

A. Barbara, J. Ferreira, L.J.O.C. Lanca; *Lisbon/PT*

Purpose: To evaluate preventable exposure dose in routine chest CT examinations beyond prescribed anatomical landmarks and estimate extra dose delivered to the patient.
Methods and Materials: A sample of 102 routine adult chest CT examinations (53 male and 49 female) was retrospectively analysed. All the scans were acquired with a MDCT (8-slice). Using the CT-Expo software, organ effective dose (lungs, oesophagus, heart, bone, thyroid, kidneys and adrenal glands) were estimated. A significance level of $p < 0.05$ was used for statistical analysis to test any statistical differences between the effective dose from the performed CT scans and the desirable scans accurately planned and referenced to the prescribed landmarks.
Results: 93% of chest CT examinations were planned and acquired beyond the prescribed anatomical landmarks. The mean effective dose in the 7 organs for the acquired exam versus the desirable prescribed landmarks under the routine scanning protocol was as follows: lungs (59.2 mSv vs 57.7 mSv); oesophagus (56.2 mSv vs 57.3 mSv); heart (52.1 mSv vs 49.8 mSv); bone (43.0 mSv vs 42.2 mSv); thyroid (13.6 mSv vs 30.3 mSv); kidneys (37.0 mSv vs 12.2 mSv); and adrenal glands (42.8 mSv vs 29.2 mSv). Statistical significant differences in effective dose ($p < 0.05$) were found in all organs, where extra-coverage was found, except thyroid. Major differences were found in kidneys (24.8 mSv) and thyroid (-16.7 mSv) due the fact that those organs are located at the anatomical boundaries.
Conclusion: An accurate scanning protocol should be followed to avoid unnecessary dose delivered to the patient.

B-0627 11:24

Do radiographers' inform parents? An investigation into disclosure of radiation risks in paediatric CT in Ireland

K. Foley-Friel, L.A. Rainford, M.-L. Butler; *Dublin/IE*

Purpose: Computed tomography (CT) is widely regarded as a high radiation dose imaging modality and its use amongst the paediatric population is rapidly increasing. Communicating the benefits and risks of CT with parents will allow an informed decision to be made in the child's best interest. The aim of the study was to establish current practice surrounding radiographers' disclosure of radiation risks to parents prior to paediatric CT examinations.
Methods and Materials: Postal questionnaires (n= 60) were distributed to the specialised national paediatric centres (n=3) in Ireland and three regional hospitals performing both adult and paediatric examinations. Key topics in the questionnaire included the practice of informing parents about radiation risks in paediatric CT and radiographers' opinions on discussing radiation risks.
Results: A response rate of 67% was attained and of these, 20% indicated routinely informing parents of radiation risks in paediatric CT, whilst 90% inform of scan duration and 95% inform about equipment movements. In addition, 24% stated radiation risks should be discussed with parents, and 60% stated this responsibility lies with the radiographer and referring clinician. Radiographer responses indicated that they believed parents wished to be informed of CT radiation risks (n= 52%).
Conclusion: The majority of radiography responses indicated that they do not routinely disclose radiation risks to parents (n=80%), despite over 50% of radiographers' opinion stating that parents wish to be informed of them. No departmental protocols related to the disclosure of radiation risks for CT examinations performed were identified.

B-0628 11:33

Operator dependency in protocol assignment could be suppressed if tuning the AEC strength curve from average to strong

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Purpose: To investigate the impact of tuning the Automatic Exposure Control (AEC) strength curve from "average" to "strong" on image quality, radiation dose, and operator dependency during lumbar spine CT examinations.
Methods and Materials: Two hospitals (H1 and H2), both using the same scanners, were considered for two time periods (P1, P2). During P1, the AEC curve was "average" and radiographers had to select one of two protocols according to the BMI: "Standard" if BMI 30.0 (140 KV-280 mAs). During P2, the AEC curve was changed to "strong" and all acquisitions obtained with one protocol (120 KV and 270 mAs). Image quality was scored and patients' diameters calculated.
Results: Data of 497 examinations were analysed. There was no significant difference in mean diameters according to hospitals and periods ($P > .801$), and in quality scores between periods ($P > .172$). There was a significant difference between hospitals regarding how often the "large" protocol was assigned (13/132 patients (10%) in H1, vs. 37/133 (28%) in H2) ($P < .001$). During P1, CTDIvol was higher in H2 (+13%; $P = .050$). In both hospitals, CTDIvol was reduced between periods (-19.2%, in H1, -29.4% in H2, $P < .001$).
Conclusion: An operator dependency in protocol selection, unexplained by patient diameters or by image quality scores can increase radiation dose during lumbar spine CT. Tuning the AEC curve from average to strong enables suppressing this operator dependency while reducing the dose and preserving image quality.

B-0629 11:42

Reference dose levels in head computed tomography: a pilot study performed during traineeship in three Portuguese health institutions

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Purpose: The main objectives of this study were to, during radiography internship, verify if effective dose values associated with CT head scan were consistent with ones referenced in the European Guidelines and to verify if the exposure parameters were adjusted to different groups of patients namely in paediatric examinations.
Methods and Materials: Data were obtained in three Portuguese medical institutions during Radiography internship. Dose-Length Product (DLP), age and sex of 239 patients were collected and were included all head examinations without contrast, regardless of pathology. With the DLP values, effective dose (E= EDLP•DLP) was calculated using the normalised effective dose for adults (EDLP=0.0023mSv•mGy-1•cm-1) and children (EDLP = 0.0040mSv•mGy-1•cm-1 - 5 years; EDLP = 0.0032mSv•mGy-1•cm-1 - 10 years??).
Results: The study sample is composed by 239 patients (53% female and 47% male) divided into 2 groups one between 17 and 100 years and other, paediatric sample, composed of 8 cases aged between 5 and 16 years. Values of mean effective doses obtained for adults (4,55 ±1,50mSv) were higher than the European Guidelines values (2,41 mSv). For paediatrics patients, we expected to find lower values than for adults and that was not observed (5 years category 4,62 ± 2,03 mSv; 10 years category 4,74±3,13 mSv).
Conclusion: Comparing with the European Guidelines we found that, for both adults and children, the effective dose values suggested the need to optimise practices in head CT studies.

B-0630 11:51

Colorectal liver metastasis' changes during different systematic chemotherapy treatment

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Purpose: Colorectal cancer is one of the most common cancer and the liver is the most common site of colorectal metastases. There are several therapeutic options - surgical, local or systemic chemotherapy - to manage metastases. The statistical analysis is indispensable and it gives very useful information to change the best treatment.
Methods and Materials: Between 01.10.2008 and 01.07.2013 we examined 2430 oncological patients with a known primary colorectal tumour. These patients underwent contrast-enhanced CT (a Siemens Somatom Definition AS+ 2x64 detector, row MDCT) and/or a contrast-enhanced liver MRI (a Siemens Magnetom Symphony 1.5 T and a Siemens Magnetom Verio 3 T). MATLAB software was used to made statistical analysis. We analysed the visual appearance, the type of the chemotherapy treatment and studied how they changed during the course of treatment.
Results: We found liver metastases in 142 patients. We divided the patients into 3 groups, based on the type of the systematic chemotherapy treatment. The Folfox seemed to the best method: 23 regression (decreased the size, number of the mass and changed their structure) 12 unchanged status (no change in the status of mass) 19 progression. De-Gramont: 6 regressions and 34 progressions. Folfiri: 34 progressions, 2 unchanged status, 12 regressions.
Conclusion: The aims of chemotherapy in unresectable colorectal liver metastases to prolong survival, decrease the size and control symptoms. There is no universally accepted standard therapy. Statistical analysis is very important the clinical medicine, but it's not worth to based the treatment on these analysis.
Author Disclosures:
M. Kiss: None. **B. Lombay:** None.

10:30 - 12:00 **Room P**

GI Tract

SS 901b

Esophageal and gastric neoplasms: new trends

Moderators:
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B-0631 10:30

Value of oral effervescent powder administration for multidetector CT evaluation of oesophageal cancer

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Purpose: To assess the value of oral effervescent powder administration for detection and staging of oesophageal cancer at contrast-enhanced CT.
Methods and Materials: 84 patients without oesophageal pathology and 52 patients with histological confirmed diagnosis of oesophageal cancer referred for CT were included in this prospective IRB-approved study (99m/37f, mean age 61y). Half of the patients of each group were orally administered 3 g effervescent powder (EP) prior to image acquisition. Oesophageal distension was assessed (proximal/middle/distal/tumour level) by volumetry of the inner (ID) and outer diameter (OD). Two blinded readers separately evaluated the datasets regarding diagnosis of oesophageal cancer (yes/no) and staging (T0-T4), if applicable. Distension results were compared (T-Test). In patients with cancer sensitivity, specificity, negative (NPV) and positive (PPV) predictive values were calculated. Staging results were evaluated (Cohen-k).
Results: ID and quotient ID/OD were significantly larger at all levels after EP as compared to the control ($p < 0.05$; mean ID:1.1 vs. 0.42, mean ID/OD:0.34 vs. 0.13). For both readers sensitivity, specificity, NPV and PPV for detection of cancer were as follows: 78%/78%, 98%/98%, 95%/95%, 87%/87% after EP; 60%/68%, 98%/98%, 94%/94%, 80%/83% without EP. Staging after EP was good (k=0.838/0.674) and moderate without EP (k=0.576/0.592). Interobserver agreement for detection and staging of tumour was very good (k=0.830) and good (k=0.741) after EP, and good (k=0.774) and moderate (k=0.591) without EP, respectively.
Conclusion: Oral administration of effervescent powder at CT results in good distension of the oesophagus, and improves detection and staging of oesophageal cancer, as compared to studies without effervescent powder.

B-0632 10:39

DW-MRI in gastro-oesophageal cancer: can ADC be considered a prognostic biomarker and used for preoperative risk stratification?

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Purpose: To investigate the role of apparent diffusion coefficient (ADC) as a biomarker in the evaluation of the aggressiveness of gastro-oesophageal tumours.
Methods and Materials: Written informed consent was obtained from each Patient. 78 Patients (54 men - 24 women; mean age 64.6 years) with biopsy-proven disease (13 oesophageal, 13 gastro-oesophageal junction and 52 gastric cancer) were examined with a 1.5 T MR system including T1, T2 and DWI (*b* values 0-600 s/mm^2) sequences. 52/78 Patients (67%) were treated with surgery while 26/78 Patients (33%) were submitted to neaodjuvant therapy and then restaged with MR before surgery. All participants were followed up for a median of 18.33 months. The role of ADC, tumour site, post-operative T and N stage and histotype was investigated by univariate and multivariate analysis using Cox regression model and Kaplan-Meier curves.
Results: Of the 78 Patients, 62 (80%) were alive and 16 (20%) had died. Median overall survival was 36 ± 8.59 months (C.I. 19.1-52.8). Considering all the variables, our results showed that ADC values below 1.4 x 10^{-3} mm^2/s can

predict a negative prognosis both in the total population (n=78; p=0.010) and in Patients directly treated with surgery (n=52; p=0.014).
Conclusion: Our study suggests the potential role of ADC as a quantitative biomarker reflecting the aggressiveness of gastro-oesophageal lesions and may be useful for pre-operative risk stratification considering the role of ADC as an independent prognostic factor.

B-0633 10:48

Dual-energy CT: relationship between iodine concentration in perigastric adipose tissue and serosa invasion for gastric cancer

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Purpose: To investigate the relationship between iodine concentration (IC) in perigastric fat by dual-energy CT (DECT) and serosa invasion for gastric cancer using histopathologic result as reference.
Methods and Materials: 48 patients with gastric cancer undergoing preoperative DECT and surgery were enrolled. The T staging according single-energy venous phase images was compared with the pathological T stage. The IC of perigastric adipose tissue was measured at arterial phase (AP) and portal venous phase (PVP), respectively. Receiver operating characteristic was used to determine the threshold of IC for detecting serosa invasion. The effective radiation dose of unenhanced, arterial and portal venous phase scan was calculated.
Results: The accuracy of T staging according single-energy venous phase images was 58.33% (28/48). IC was significantly higher in serosa invasion group than that of uninvaded group (AP: 0.60±0.34 vs. 0.12±0.22 mg/ml, Z=-4.240,p=0.000; PVP: 0.83±0.41 vs. 0.29±0.23 mg/ml, Z=-4.292,p=0.000). With a threshold of 0.25 mg/ml at AP, the sensitivity and specificity for detecting serosa invasion was 84.4% and 81.2%. With a threshold of 0.45 mg/ml at PVP, the sensitivity and specificity was 87.5% and 81.2%. The effective radiation dose of unenhanced, arterial and portal venous phase was 5.08±1.20, 4.39±1.46, and 4.58±2.42 mSv, respectively.
Conclusion: DECT and iodine quantification in perigastric fat is an accurate method to detect serosa invasion for gastric cancer.

B-0634 10:57

Comparison of computed tomographic perfusion and 18 FDG/PET-CT in the diagnosis of primary oesophageal cancer

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Purpose: To assess the relationship between PET/CT and CT perfusion performed for staging of primary oesophageal cancer.
Methods and Materials: Nineteen patients undergoing PET/CT for oesophageal cancer staging were enrolled. Subsequently, CT perfusion and thoracoabdominal CT with contrast were performed for the oesophageal masses. Oesophageal tumour diameters were divided into three groups: 5-15 mm, 15-25 mm, and 25-35 mm. For each group, lymph node metastasis and distant metastasis, as well as the mean CT perfusion and SUVmax values, were calculated. CT perfusion parameters of blood volume (BV), blood flow (BF), and permeability surface (BMP) were compared with the PET parameter SUVmax. Tumour diagnosis was confirmed histopathologically in all the patients. Correlation between the tumour grade, pathological cell types, and the SUVmax and CT perfusion parameters calculated in tumour mass were compared.
Results: In all stages, no significant difference was found between CT perfusion and SUVmax values in oesophageal cancers with varying histological types and tumour diameters ($P > 0.05$). There was no significant difference between the CT perfusion parameters in the Stage 1, 2, and 3 oesophageal cancers ($P > 0.05$). However, there was a significant difference between Stage 4 and the other stages with respect to the BF values ($P < 0.0213$). In Stage 1, no measurable FDG uptake was detected in four cases with a tumour diameter of 6 to 12 mm. However, CT perfusion values of were measured in all cases.
Conclusion: The CT perfusion technique is a feasible method for evaluating oesophageal cancers with small tumour diameters that are not amenable for assessment with PET/CT.

B-0635 11:06

A prospective trial for the evaluation of esophageal cancer patients: fluorodeoxyglucose (FDG) positron emission tomography (PET)/computed tomography (CT) vs contrast enhancement (c.e). CT vs. FDG PET/c.e.CT

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Purpose: We reported the preliminary data about the comparison of diagnostic performance among PET/CT, c.e.CT and PET/c.e.CT in oesophageal cancer patients.
Methods and Materials: 60 EC patients (46 male, 62±12 years) who underwent basal PET/CT plus c.e.CT in a single session, were recruited. After 60 min from the injection of FDG, a whole body PET/CT scan was acquired. At the end of standard acquisition, a neck-thorax-abdomen c.e. CT was performed; in particular, three c.e. phases for the liver evaluation were made. Three specialised physicians (two radiologists and two nuclear medicine specialists) read the images, separately. The diagnostic performances of PET/CT, PET/c.e.CT and c.e.CT were evaluated by using the standard method and then compared with clinical staging (by patient-based analysis).
Results: 60 patients performed both PET/CT and c.e.CT while 57 of them had all three scans. The imaging co-registration (PET and c.e.CT) was good in 88% of patients, discrete in 7% and scarce in only 5%. The agreement among the three scans was present in 35% of subjects. In the remnant 65% of patients, c.e.CT demonstrated more lymph node metastases than both PET/CT and PET/c.e.CT (15 and 11%, respectively), similarly PET/c.e.CT showed more loco-regional/distant lymph nodes and distant metastases than PET/CT (increase in positive rate=30%). The clinical staging was recovered in 28 (41%) patients. The positive predictive value of PET/c.e.CT was higher than PET/CT and c.e.CT for the identification of loco-regional/distant lymph nodes and distant metastases (81 vs.78% and 70%, respectively).
Conclusion: In EC patients, FDG PET/c.e.CT represents an accurate and feasible method for recognising a major number of pathological findings in comparison with PET/CT and c.e.CT.

B-0636 11:15

Diagnostic performance of MDCT in preoperative assessment for lymphatic gastric cancer spread in the era of neoadjuvant treatment: is a double dimensional cut-off a reliable approach?

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Purpose: To validate the accuracy of MDCT in the pretreatment lymphonode (LN) definition in patients with Gastric Cancer (GC), using a double dimensional cut-off.
Methods and Materials: 135 patients with primary GC, who underwent an MDCT staging scan followed by radical surgical treatment, were retrospectively, blindly and independently evaluated by a resident (reviewer1) and an experienced radiologist (reviewer2). All patients were staged according to the 3rd edition of Japanese Classification of Gastric Carcinoma (JCGC). Regional LNs were considered involved when the short-axis diameter (SaD) was >/= 5 mm for nodes of level 1 and >/= 8 mm for those of the other level, according to the distance of the LNs from the primary tumour. Cohen K test was used to evaluate the inter-observer agreement.
Results: LN invasion was found in 83 cases (66%). The N staging overall accuracy was 84% (reviewer1) and 90% (reviewer2). There was a statistical significant difference between the maximum SaD of pathological LNs of levels 1 and 2 ($p < 0.05$), of intestinal and diffuse type ($p < 0.01$), intestinal and mixed type ($p < 0.05$), and intestinal and diffuse/mixed type ($p < 0.005$). MDCT diagnostic accuracy was maximised using a double dimensional cut-off, 5 mm for LNs of level 1 and 7.7 mm for LNs of level 2. None of the T2 cases were understaged.
Conclusion: A double dimensional cut-off for level 1 and 2 according to the distance of the LNs from the primary tumor encourage the use of MDCT as the only technique sufficient to assess lymphatic cancer spread in the staging of GC.

B-0637 11:24

Differentiation of early gastric cancer with ulceration and advanced gastric cancer using multiphasic dynamic multidetector CT

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Purpose: Early gastric cancer with ulceration (EGC-U) mimics advanced gastric cancer (AGC) because they could have similar endoscopic findings with ulceration. The purpose of this retrospective study was to determine whether enhancement at multiphasic dynamic multidetector row computed tomography (MDCT) can help differentiate EGC-U from AGC.
Methods and Materials: Seventy-four consecutive patients with pathologically proven EGC-U (UI-II-IV) and AGC (T2-T4a) were enrolled. Preoperative MDCT images were obtained 40s (arterial phase), 70s (portal phase) and 240s (delayed phase) after injection of nonionic contrast material. We compared the CT attenuation value of EGC-U and AGC using t test. We also performed receiver operating characteristic (ROC) analysis to determine the optimal threshold levels to differentiate EGC-U from AGC.
Results: Of the 74 cases, 40 cases (16 EGC-U and 24 AGC) were detectable in all three phases, which were analysed. Mean enhancement of EGC-U and AGC peaked in the delayed and portal phase, respectively. The CT attenuation value of EGC-U was significantly lower than that of AGC in both the arterial (66 HU vs 107 HU, P <.0001) and portal (75 HU vs 115 HU, P <.0001) phases. The sensitivity, specificity, and accuracy in differentiating EGC-U from AGC were 81%, 88%, and 85%, respectively, for arterial phase and 88%, 100%, and 95%, respectively, for portal phase.
Conclusion: Enhancement at multiphasic dynamic MDCT can help differentiate EGC-U from AGC.

B-0638 11:33

A comparison study with fluoroscopy: can CT scan predict anastomotic leaks after gastric surgery?

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Purpose: To assess diagnostic performance of CT for detecting anastomotic leaks after gastric surgery comparison with fluoroscopy and to analysis clinical role of immediate postoperative CT after gastric surgery.
Methods and Materials: Our study consisted of 179 patients who underwent CT and fluoroscopy after gastric surgery. We categorised patients as follows: Group I, leak on fluoroscopy; Group II, possible leak on CT but negative on fluoroscopy; Group III, no leak. Two reviewers independently rated the possibility of leak on CT using a five-point scale. They evaluated presence or absence of predefined CT findings. We also analysed the relationship between clinical data and different groups. ROC curve analysis, Chi-Square test and Student t-test were used for statistical analysis.
Results: AUC for detecting leak on CT was 0.886 in R1 and 0.668 in R2 with moderate agreement ($\kappa = 0.482$). Statistically common CT findings for leak included discontinuity at the anastomosis site, large amount of air-fluid, and wall thickening at anastomosis site ($p < 0.05$). Discontinuity at the anastomosis was independently associated with the leak (p=0.0001). The hospitalisation period and postoperative fasting period was longer on Group.i. than Group II or Group III ($p < 0.05$). Group II showed longer total recovery period than Group III ($p < 0.05$). However, surgical type (laparoscopic vs. open surgery) showed no statistical difference on different groups.
Conclusion: Postoperative CT was useful for prediction of anastomotic leaks using specific imaging findings. Also these CT findings can predict total recovery period.

B-0639 11:42

MRI characteristics of anal carcinoma: analysis in a cohort of 51 patients

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Purpose: The number of anal carcinoma is increasing and MR imaging is becoming method of choice for staging and follow-up. The purpose of this study was to evaluate the primary MRI appearances of anal carcinoma in a large cohort of patients.
Methods and Materials: A review was performed on 51 biopsy-proven anal carcinoma, where MRI was used for primary staging using T2-weighted images (T2WI), T1WI after gadolinium chelate injection, and diffusion WI. The size, the extent and the signal characteristics of the anal tumour, as well as the nodal spreading were recorded. The characteristics were compared according to the sex.
Results: Relative to the internal anal sphincter, tumours appear with very high signal intensity (SI) in all cases on diffusion WI, and with high SI in 80% of cases on T2WI (58% discrete, 22% frank high SI). On Gd-enhanced T1-WI (T1+Gd), 77% tumours showed low SI, with a peripheral rim of high SI in 37%. Lymph node metastases showed slight high SI on T2WI, and frank high SI on T1+Gd. The median craniocaudal and circumference diameters were 4.5 cm (IC95% [3.8-5.3]) and 213° (IC95% [182-245]). At diagnosis, women were older than men (62 vs. 54 yo) The circumferential involvement and the number of T4 was more important in women (360° in 37% vs. 6%, < 180° in 11% vs. 44%, T4 in 49% vs. 13%) ($p < 0.05$).
Conclusion: MRI is an excellent means of assessing primary anal carcinomas, which appearances are different in older women than in young men.

B-0640 11:51

The prognostic value of tumour volume and lymph node metastasis for oesophageal carcinoma

G. Shi, Q. Xu; *Shijiazhuang/CN (gaofengs62@sina.com)*

Purpose: To investigate the relationship between tumour volume and lymph node metastasis, and its prognostic value of oesophageal carcinoma.
Methods and Materials: Six hundred and seven patients (413 males 194 females,age range 26 - 78 years) received the radical resection of thoracic oesophageal carcinoma were enrolled. According to postoperative pathology, the number of lymph node metastasis was 0 in 371 cases, 1 in 107 cases, 2 in 51 cases, 3 in 35 cases, ≥4 in 43 cases. These patients' preoperative CT images were used for tumour volume measurement. The patients were followed up for a duration ranged from 1 to 75 months (mean 39 months). The relationship between tumour volume, number of lymph node metastasis and patient prognosis was investigated.
Results: The tumour volume had significant difference between N0 and N1 stage ($P < 0.001$). The tumour volume had significant difference between 1 lymph node metastasis group and ≥4 lymph nodes metastasis group (P0.05). The tumour volume had a positive correlation to lymph node metastasis ($r=0.230, P < 0.001$). The 1, 3, 5-years survival rates after the surgery date were 83.32%, 53.33%, 36.02%, respectively. The survival rate was significant difference between N0 and N1 stage ($P < 0.001$). Significant difference also existed between 1 and ≥2 lymph nodes metastasis group ($P < 0.01$). Cox regression model showed that the independent prognostic factors are: tumour volume, the number of lymph node metastasis, pathological type, lesion region ($P < 0.05$).
Conclusion: Oesophageal carcinoma tumour volume is related to lymph node metastasis with a positive correlation, and it is an independent prognostic factor of post-surgery survival rate.

Sunday, March 9

10:30 - 12:00 **Room A**

Oncologic Imaging

SS 1316

Tumour staging: whole-body MRI and MR/PET

Moderators:
M. Mayerhöfer; Vienna/AT
A.G. Rockall; London/UK

B-0641 10:30

One-step TNM staging of high-risk prostate cancer during a single MR imaging session

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Purpose: Multiparametric MRI (mpMRI) is the standard for local (T)PCa staging. Whole-body MRI (wbMRI) is effective for the metastatic screening. This study assesses the feasibility and value of an "all-in-one" TNM staging combining mpMRI and wbMRI.
Methods and Materials: 30 patients with "high-risk" PCa (PSA> 20 ng/ml, Gleason≥ 8, or T stage≥ 3a) underwent wbMRI including diffusion-weighted imaging (DWI) and prostate mpMRI in addition to the standard bone (M) and node (N) screening [bone scintigraphy ± targeted x-rays if necessary (BS±TXR) and contrast CT]. A "best valuable comparator" (BVC) integrating all initial and follow-up imaging, biological, and clinical data were used to adjudicate N and M metastatic status.
Results: Local (T) staging was feasible in all patients using ESUR guidelines. Based on the BVC, 13 patients had metastases. Sensitivity of BS±TXR and wbMRI for detecting bone metastases was 89% and 100%; specificity was 90% and 100%, respectively. Sensitivity of CT and wbMRI for detecting node metastases was 82% and 100%; specificity was 100% for both. Sensitivity of BS±TXR combined with CT and of wbMRI for detecting metastases was 85% and 100%; specificity was 88% and 100%, respectively. For the overall staging of the patients as being either N0M0 or having disease extension beyond the prostate, wbMRI was superior to the BS±TXR and CT combination [improvement in AUC by 13.6%, P=0.0392].
Conclusion: TNM staging of PCa is feasible in less than one hour in an MRI session combining mpMRI and wbMRI, outperforming BS±TXR and CT for discriminating patients with or without metastasis.
Author Disclosures:
V.P. Pasoglou: Grant Recipient; FNRS/TELEVIE GRANT. Research/Grant Support; Fondation contre le cancer.

B-0642 10:39

Contrast enhanced total spine MRI and DWI evaluation of disease activity in monoclonal gammopathy of undetermined significance and multiple myeloma

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Purpose: The aim of our study was to evaluate the diagnostic value of total-spine contrast -enhanced MRI and DWIBS (with high B-value) in the prognosis and assessment of therapy in Monoclonal Gammopathy of Undetermined Significance (MGUS) and Multiple Mieloma (MM).
Methods and Materials: We studied, retrospectively, 56 patients affected of MGUS (38) and MM (18) before treatment and after induction chemotherapy. The results were matched with hematologic values and bone-biopsy. Were used sequences pre- and post-contrast and DWIBS. The values were obtained by ROIs positioned on pathologic vertebral bodies. Post-treatment changes in ROIs Signal Intensity were compared with clinical response to therapy and with bone-biopsy by using the Mann-Whitney U test.
Results: Lower homogeneous signal intensities in T1 Weighted images associated with a moderate enhancement after contrast administration and irregular high signal intensity in DWIBS were negative prognostic value in MGUS, then changed in symptomatic MM ($P < 0.001$). In patients affected of MM, the absence of significant enhancement in T1 SPIR sequence post-contrast material injection ($p < 0.002$) and a low signal in DWIBS ($p < 0.001$), were indicative for therapeutic efficacy.
Conclusion: The combined MRI study of MGUS patients by DWIBS and contrast enhanced MRI of Total Spine is useful for early diagnosis and to predict the change in MM, then supply by bone-biopsy. In MM, treatment response patients correspond to absence of contrast enhancement and low-signal in DWIBS.

B-0643 10:48

Tumour load in patients with multiple myeloma: ß-2 Microglobulin levels vs whole-body MRI

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Purpose: ß-2 microglobulin is a serum maker of tumor burden in hematologic malignancies. We aimed to correlate serum ß-2microglobulin levels in patients with multiple myeloma (MM) to tumor mass determined by whole-body-MRI (WBMRI)
Methods and Materials: We retrospectively included patients with a new diagnosis of MM and a WBMRI prior to treatment at our institution between 2003-2011. Patients with a GFR < 60 ml/min were excluded from further analysis since ß-2 Microglobulin levels are increased in those patients. 30 patients without renal impairment could be included. WBMRI exams (T1-w TSE + STIR) were assessed by two expert musculoskeletal radiologists in consensus for focal lesions and for the presence of diffuse myeloma infiltration. The grade of diffuse infiltration was confirmed by histology as gold standard. Patients were staged according to the Durie & Salmon PLUS Staging System.
Results: According to WBMRI findings, 13 patients were classified as D&S PLUS Stage I (low-grade), 6 as Stage II (intermediate-grade) and 11 as Stage III (high-grade). As expected, most of the stage I patients (12/13) had normal ß-2 microglobulin levels (≤3 mg/L). 5/6 patients in stage II and 5/11 patients in stage III showed normal ß-2 microglobulin levels. Thus 10/17 patients (58.8%) with substantial infiltration in the bone marrow showed false negative ß-2 microglobulin levels.
Conclusion: ß-2 microglobulin levels as a marker of tumor load may be misleading in a number of patients with substantial myeloma infiltration in the bone marrow. WBMRI may display the full tumor load and correctly show the extension of myeloma infiltrates.

B-0644 10:57

The non-contrast-enhanced whole body magnetic resonance imaging in the general population: the prevalence of abnormal findings in two age groups

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Purpose: To assess the incidence of abnormal findings detected during non-contrast-enhanced whole body magnetic resonance imaging (WB-MRI) in general population in two age groups: ≤50 years of age (yoa) and in older patients.
Methods and Materials: Analysis included 666 non-contrast-enhanced WB-MRIs performed on 1.5-T scanner between December 2009 and April 2013 in private hospital in 451 patients ≤50 yoa and 215 patients > 50 yoa. Following images were obtained: T2-STIR (whole body-coronal plane), T2-STIR (whole spine-sagittal), T2-TSE with fat-saturation (neck and trunk-axial), T2-FLAIR (head-axial), 3D T1-GRE (thorax-coronal, axial), T2-TSE (abdomen-axial), chemical shift (abdomen-axial). Detected abnormalities were classified as: unimportant (type I), potentially significant, requiring medical attention (type II), significant, requiring treatment (type III).
Results: There were 3375 incidental findings depicted in 659 (98%) subjects: 2997 type I lesions (88.8%), 363 type II lesions (10.8%) and 15 type III lesions (0.4%), including malignant or possibly malignant lesions in 7 subjects. The uppermost differences in the prevalence of abnormalities on WB-MRI between patients ≤50 yoa and > 50 yoa concerned: brain infarction (22.2%, 45%, respectively), thyroid cysts/nodules (8.7%, 18.8%), pulmonary nodules (5%, 16.2%), significant degenerative disease of the spine (23.3%, 44.5%), extra-spinal degenerative disease (22.4%, 61.1%), hepatic steatosis (15.8% vs. 24.9%), liver cysts/hemangiomas (24%, 34.5%), renal cysts (16.9%, 40.6%), prostate enlargement (5.1%, 34.2% of males), and uterine fibroids (16.3%, 37.9% of females).
Conclusion: The incidental findings were detected in almost all subjects. WB-MRI demonstrated that the prevalence of most of abnormalities increases with age.

B-0645 11:06

Diagnostic accuracy of simultaneously acquired FDG-PET/MRI for the detection of sentinel lymph node metastases in malignant melanoma patients

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Purpose: Sentinal lymph node (SNL) biopsy as an invasive procedure is still under discussion in malignant melanoma staging. The aim of this study was to evaluate the diagnostic accuracy of simultaneously acquired FDG-PET/MRI for the detection of sentinel lymph node metastases in patients with histologically proven malignant melanoma.

Methods and Materials: 30 consecutive patients with histopathologically confirmed malignant melanoma and scheduled for FDG-PET/CT were prospectively enrolled for an additional, integrated whole-body PET/MRI scan (Biograph mMR, Siemens). The PET/MRI protocol comprised the following MR sequences: 1) T1w FLASH pre and post-contrast, 2) T2w HASTE, 3) DWI. All patients underwent SNL-biopsy serving as the standard of reference. Sensitivity, specificity, PPV, NPV and accuracy of FDG-PET/MRI for the detection of sentinel lymph node metastases was evaluated on a compartment basis.
Results: Sensitivity, specificity, PPV, NPV and accuracy of FDG-PET/MRI for the detection of lymph node metastases was 33%, 100%, 100%, 80% and 82%. In early stages, there was a high rate (6/30) of false negative results.
Conclusion: FDG-PET/MRI yields a relatively high diagnostic accuracy for the detection of sentinel lymph node metastases. Results in early stages should be rated with caution due a high rate of false negative results.

B-0646 11:15

Comparison of 18 F-FDG PET/MRI and MRI alone for whole body staging of female patients with recurrent pelvic malignancies

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Purpose: To compare the diagnostic potential of integrated 18 F-FDG PET/MRI and MRI alone for whole-body staging of patients with recurrent malignancies of the female pelvis.
Methods and Materials: 20 patients with suspected recurrence of cervical or ovarian cancer were included in our study. All patients underwent whole-body 18 F-FDG PET/MRI (Biograph mMR, Siemens). The MR protocol included 1) T1 2D FLASH pre and post contrast, 2) T2 HASTE and 3) DWI. Two readers evaluated separately the following datasets subsequently (A) 18 F-FDG PET/MRI, (B) whole-body MRI including DWI, regarding (1) lesion count, (2) lesion conspicuity (4-point ordinal scale), (3) lesion dignity (benign/malignant/indeterminate) and diagnostic confidence (3-point ordinal scale). Wilcoxon's signed-rank test was applied to assess statistical significance.
Results: Malignant lesions were present in 17 of 20 Patients. A total of 81 lesions, comprising 61 malignant and 20 benign lesions were detected. PET/MRI offered correct and superior identification of all 17 patients with cancer lesions, compared to MRI alone (15/17). Additionally, 18 F-FDG PET/MRI exhibited a significant higher conspicuity (PET/MRI: 3.91±0.28; MRI+DWI: 3.66±0.63) and diagnostic confidence (PET/MRI:2.79±0.43; MRI+DWI: 2.15±0.72) in the detection of malignant lesions ($p < 0.01$). 18 F-FDG PET/MRI also offered a superior conspicuity in the detection of benign lesions (MRI: 3.23±1.14; MRI+DWI: 3.13±1.24).
Conclusion: The results demonstrate the superiority of 18 F-FDG PET/MRI in detecting malignant and benign lesions compared to MRI alone. Thus, whole body PET/MRI seems to be a more powerful diagnostic modality for staging of patients with suspected pelvic malignancies.

B-0647 11:24

Whole-body [18 F]-FDG PET/MRI vs PET/CT in staging of recurrent malignancies of the female pelvis: first results

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Purpose: To evaluate the diagnostic potential of whole-body PET/MRI with [18 F]-FDG in recurrent ovarian and cervical cancer in comparison to whole-body PET/CT.
Methods and Materials: 19 patients with suspected recurrence of pelvic malignancies (ovarian cancer, n=11; cervical cancer, n=8) scheduled for a contrast-enhanced PET/CT with [18 F]-FDG (Biograph mCT 128, Siemens) were enrolled for a subsequent whole body PET/MRI examination (Biograph mMR, Siemens). The protocol comprised: 1) T1 FLASH 2D ax. pre and post-contrast, 2) T2 HASTE ax., 3) STIR cor., 4) DWI. The resulting datasets (PET/CT, PET/MRI) were rated by two radiologists with regard to lesion count, lesion conspicuity (4 point ordinal scale), dignity (benign/malignant/indeterminate) and diagnostic confidence (3 point ordinal scale). All available data (prior examinations, PET/CT, PET/MRI, clinical follow-up) served as standard of reference. Mean values were compared using Wilcoxon rank sum test.
Results: Malignant lesions were present in 16 of 19 subjects. A total of 78 lesions (malignant, n = 58; benign, n = 20) were described. Both PET/CT and PET/MRI allowed for identification of all malignant lesions and provided equivalent conspicuity (PET/CT: 3.86±0.35 PET/MRI: 3.91±0.28). Diagnostic confidence was significantly higher for PET/MRI in malignant lesions (PET/CT:2.65±0.53; PET/MRI:2.78±0.44, $p < 0.01$) as well as benign lesions (PET/CT:1.74±0.72; PET/MRI:2.18±0.76, $p < 0.05$).
Conclusion: Both modalities offer an equivalently high diagnostic value for recurrent pelvic malignancies. PET/MRI offers higher diagnostic confidence in the discrimination of benign and malignant lesions. Considering the reduced radiation dose and superior lesion discrimination, PET/MRI may serve as powerful alternative to PET/CT in the future.

B-0648 11:33

Thoracic staging in lung cancer: [18 F]-FDG-PET/MRI vs [18 F]-FDG-PET/CT

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Purpose: To compare a dedicated pulmonary [18 F]-FDG-PET/MRI protocol to [18 F]-FDG-PET/CT for primary and locoregional lymph node staging in NSCLC patients using histopathology as the reference.
Methods and Materials: Twenty-two NSCLC patients (mean age 65.1±9.1 years) underwent FDG-PET/CT followed by a FDG-PET/MRI, including a dedicated pulmonary MRI protocol. T- and N-staging was performed according to the 7th edition of the AJCC staging manual by two readers in separate sessions for FDG-PET/CT and FDG-PET/MRI, respectively. Histopathology was used as the reference standard for T- and N-stage. The maximum standardised uptake value (SUVmax) was measured. SUVmax obtained from FDG-PET/CT and FDG-PET/MRI were compared. Pearson correlation analysis and Bland-Altman plots were performed for quantitative comparison.
Results: FDG-PET/MRI and FDG-PET/CT agreed on T-stages in 16/16 of patients (100%), all patients were staged correctly when compared to the reference standard. There was no statistically significant difference between FDG-PET/CT and FDG-PET/MRI for lymph node metastases detection ($p=0.48$). For definition of thoracic N-stages FDG-PET/MRI and FDG-PET/CT were concordant in 20/22 patients (91%). FDG-PET/MRI and FDG-PET/CT determined the N-stage correctly in 20/22 patients (91%) and 18/22 patients (82%), respectively. The SUVmax of NSCLC was 12.0±5.7 for FDG-PET/MRI and 10.5±5.3 for FDG-PET/CT. SUVmax values based on FDG-PET/CT and FDG-PET/MRI correlated well ($R=0.86; p < 0.0001$). Using Bland-Altman analysis, the lower and upper limits of agreement between PET/CT and PET/MRI were −7.42 to 4.40 for SUVmax.
Conclusion: FDG-PET/MRI using a dedicated pulmonary MRI protocol and FDG-PET/CT are in excellent agreement on thoracic T- and N- stages and the SUVmax of the primary tumour.

B-0649 11:42

Integrated ^{18}F-FDG PET/MRI with a 16-channel breast coil for local and axillary breast cancer staging: initial results on PET imaging

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Purpose: Until lately, no PET/MR mammography compatible breast coil was commercially available. We conducted this study i) to evaluate the feasibility of FDG-PET/MRI mammography with a standard 16-channel RF breast coil and ii) to estimate the coil influence on image quality of the FDG-PET in the setting of local and axillary staging in breast cancer patients.
Methods and Materials: 42 women with histopathologically proven breast cancer underwent FDG-PET/MRM with a standard 16-channel RF breast coil subsequent to a scheduled PET/CT. Both examinations were compared with respect to lesion detection and staging, quantification of lesional uptake, PET image quality, as well as presence of artefacts. Analyses were performed both at patient and lesion level and correlated with body mass indexes (BMI). Wilcoxon signed-rank test, Mann-Whitney *U* test as well as Spearman's rank correlation were applied if appropriate.
Results: 47 lesions were detected with PET/CT vs. 46 with PET/MRM. Mean SUV_{max} determined with PET/CT for tumours and lymph nodes was 6.1±4.7 and 5.8±4.8 vs. 3.4±1.7 and 3.5±1.9 with PET/MRI ($p=0.006$/ $p=0.23$). All 42 examinations were rated as sufficient for diagnosis with PET/CT vs. 31 examinations with PET/MRI. Mean BMI of all patients with PET/MR images that were sufficient for the assessment was 23.9 vs.30.6 for images that were insufficient for assessment ($p < 0.001$).
Conclusion: Staging of breast cancer patients with integrated PET/MRI with a standard 16-channel breast coil is feasible. PET/MR provides acceptable image quality with similar staging information as compared to PET/CT. However, dedicated PET/MR breast coils are likely to improve the results, particularly in overweight patients.

B-0650 11:51

Quantification of ADC and SUV values in tumours and lymph node metastases of patients with cervical carcinoma in a simultaneous MR/PET system

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Purpose: Previous studies show discrepancies between standard uptake value (SUV) and apparent diffusion coefficient (ADC) parameters of different tumor entities with non simultaneous measurements on examination modalities such as PET-CT and MRI. The objective of this study was the quantitative evaluation of SUV and ADC values in patients with primary and recurrent cervical cancer and suspicious lymph nodes in a simultaneous PET-MRI system to deteriorate an expectable correlation

Methods and Materials: We included 17 patients with cervical carcinoma and lymph node metastases (34 lesions) who all underwent a simultaneous whole body 18 F-fluorodeoxyglucose (FDG) PET-MRI including a dedicated pelvic examination. Reader defined volume-of-interest (VOI) for ADC and SUV were placed in suspicious lesions and FDG-positive lymph nodes in regions with maximum FDG-uptake. ADC_{min}, ADC_{mean}, relative ADC value and SUV_{max}, $_{mean}$, $_{min}$ was calculated with the M.gluteus maximus serving as reference tissue. Correlation between multiple pairs were conducted via Pearson - correlation - test.

Results: Local tumor lesions and lymph nodes showed average SUV_{mean} values of 12.7 (SE ± 1.63) and 9.4 respectively (SE ± 1.59); corresponding ADC_{mean} averages amounted to 1.020 x 10^{-3} mm/s^2 (SE ± 0.104) and 1.094 x 10^{-3} mm/s^2 (SE ± 0.12). Significant inverse correlation ($p < 0.05$) could be seen in ADC_{mean} vs. SUV_{mean} and ADC_{mean} vs. SUV_{max} of tumors (-.613, -605). In all other pairs a negative inverse correlation tendency was seen ($p > 0.05$).

Conclusion: Values of ADC and SUV show a significant inverse correlation for ADC_{mean} vs. SUV_{mean} and ADC_{mean} vs. SUV_{max}.

10:30 - 12:00 **Room D**

Chest

SS 1304

Malignancies and intervention

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B-0652 10:30

Perfusion CT: an evaluation of lung tumours following microwave ablation

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Purpose: To assess changes in perfusion CT (pCT) parameters following microwave ablation (MWA) of lung tumours and determine the utility of direct visualisation of perfusion maps and pCT parameters to confirm adequate treatment and predict local tumour progression (LTP).

Methods and Materials: 15 patients with (7 primary and 8 metastatic) lung tumours underwent pCT scans immediately pre and post MWA. The tumour median size was 23 mm (range 12-52 mm). Perfusion maps of the tumours were constructed using CT perfusion 3 software (GE, Milwaukee, USA). Regions of interest were drawn on sequential axial sections to extract pCT parameters from the entire tumour volume. Data was analysed using Wilcoxon signed rank and Mann-Whitney tests. Direct visualisation of perfusion maps pre and post MWA was performed blinded to outcome.

Results: A significant difference was only found in the median blood volume pre and post MWA (3.59 vs 2.30 ml/100 mg, p=0.01). 3 patients developed LTP on follow-up imaging 6 months post MWA (mean size 38 mm vs. 23 mm in no recurrence, p=0.03). Comparison of median pCT parameters between patients with LTP and no recurrence pre and post MWA did not demonstrate any significant differences. Treatment adequacy was correctly categorised by direct visualisation of the perfusion maps for 11 out of the 15 patients with sensitivity 67%, specificity 75%, PPV 40% and NPV 90%.

Conclusion: pCT is a useful assessment tool immediately following MWA of lung tumours. Direct visualisation of the perfusion maps may allow identification of areas requiring further treatment at the time of the procedure.

B-0653 10:39

Two-phase dual energy CT in lung carcinoma: possible contribution of iodine uptake calculation in mediastinal lymph nodes with different therapy response

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Purpose: To find out potential contribution of iodine uptake change in lymph nodes (LN) therapy response assessment.

Methods and Materials: Retrospective analysis of 113 target LN (cross-sectional diameter> 10 mm) in 25 patients with non-small cell lung carcinoma, who underwent staging and follow-up (interval 6-10 weeks; mean 8.3) dual-energy CT in arterial and venous postcontrast phase, 2-4 cycles of chemotherapy was completed during interval. Segmentation of LN and iodine uptake quantification (mg/ccm) prior therapy and follow-up was performed in both phases using prototype of application (syngo.IPEPE, Siemens). Statistical comparison of the change of iodine uptake in progressed (RECIST diameter increased by 20% and more) LN (55), stabilised or regressing (58).

Results: The value of iodine uptake change in progressing LN in venous phase was significantly lower (-0.35 mg/ccm; p=0.003) comparing stabilised or regressing lymph nodes (0.05 mg/ccm). And also response of arteriovenous shift was significantly different in reference groups (-0.77 vs. 0.31 mg/cm2, $p < 0.001$). The significant difference of iodine uptake response in arterial phase was not confirmed. (p=0.3) The direct correlation of iodine uptake parameters and concrete volume or RECIST response was not found.

Conclusion: Our results confirmed possible feasibility of iodine uptake determination from dual-energy CT in LN response assessment, significant discrepancy in change of iodine uptake in mediastinal LN differently (RECIST criteria) responding to chemotherapy was confirmed. The decrease of venous iodine uptake should correspond to limited interstitial space in not responding LN. Further study must confirm and specify the possible contribution in therapy response prediction.

Author Disclosures:
T. Flohr: Employee; Siemens Healthcare. **B. Schmidt:** Employee; Siemens Healthcare.

B-0654 10:48

Transcutaneous ultrasound examination of mediastinum in lung cancer

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Purpose: Transcutaneous chest sonography of the mediastinum in lung cancer is considered to be an uninformative method. However, atelectasis of the upper lobe or of the entire lung creates an acoustic window that allows one to examine in detail the structure of the mediastinum and lung tumours to determine tumour involvement of the mediastinum. The objective of the study was to determine the possibility of transcutaneous ultrasound examination of the mediastinum in patients with lung cancer.

Methods and Materials: We have developed a technique of mediastinal ultrasound and semiotics of the tumour ingrowth into the pericardium, large vessels and heart in patients with lung cancer with atelectasis of the upper lobe or entire lung. Using this procedure, 139 patients were examined. Surgery was performed in 96 (69.1 %) of them.

Results: Using the ultrasound technique described above, the sensitivity, specificity, and accuracy of the diagnosis of lung tumour ingrowth into the pericardium equalled 85.7 %, 94.1 % and 90.7%, into the superior vena cava - 71.4 %, 100 % and 96 8%, into the pulmonary arteries - 93.8 %, 98.3% and 96.7 %, into pulmonary trunk - 100%, 98.5% and 98.6%, into the pulmonary veins - 95.8 % 98.2% and 97.5 %, and into the heart - 80%, 98.7% and 97.6 %.

Conclusion: Transcutaneous chest sonography is an effective method for diagnosing tumour involvement of organs and structures of the mediastinum in patients with lung cancer with atelectasis of the upper lobe or entire lung.

B-0655 10:57

Transthoracic core needle biopsy under CT scan for lung malignancies: predictive negative value and predictive factor of failure and complications

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Purpose: Transthoracic core needle biopsy under CT-Scan (TTCNB) is frequently used for the diagnosis of lung nodules. However, clinical value of negative results was poorly investigated. This work aims to determine the negative predictive value (NPV) of TTCNB as well as to investigate predictive factors of false-negative results and complications.

Methods and Materials: Charts of all TTCNB performed in three centres between 2006 and 2012 were reviewed. Statistics includes binary logistic regression for multi-variables analysis.

Results: Overall, 980 TTCNB were performed. Results were a malignant disease in 79% (n=777), a non-malignant disease in 6% (n=54) and a negative

(or non-contributive) result in 15% (n=149). The complication rate was 34% (life-threatening complication in 6%). In multivariate analysis, predictive factors of complication were a target size ≤10 mm and a poor training of the performer. For malignant disease diagnose, the negative predictive value was 51% and sensibility and specificity, were respectively 89% and 99%. The predictive factors found in multivariate analysis were a poor training of the performer and a FDG-uptake of the target in PET-CT (OR=8.5 [95%CI 2.3-31.9]; p=0.001). In 25 cases, a second TTCNB was performed in the same target after. Complication rate was 33% and TTCNB lead to diagnosis in 95% with a 67% NPV.
Conclusion: Around half of the negative TTCNBs are falsely negative for malignant disease, especially in case of FDG-uptake of the target nodule. However, an additional TTCNB at the same target do not increased rate of complication and leads to diagnosis.

B-0656 11:06

Three-dimensional analysis of advanced stage NSCLC: prognostic significance of volumetric measurements

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Purpose: To evaluate the reproducibility of the three-dimensional (3-D) analysis of advanced stage non-small cell lung cancer (NSCLC) using a semi-automated computer software and to determine the value of volumetric CT measurements in predicting prognosis.
Methods and Materials: CT scans of 43 measurable NSCLCs were included in this study. Four observers independently measured the greatest diameter of each lesion by using the electronic caliper on baseline and follow-up (post first cycle chemotherapy) CT scans. In the same session, a semi-automated three-dimensional lung cancer segmentation software commercially available, was applied to assess both unidimensional and volumetric measurements of the same lesions. The Bland and Altman test evaluated the interobserver variability for each measuring system; in order to further compare reproducibility between diameters and volumetric measurements, the latter were transformed into equivalent diameters by assuming the tumor as having a spherical-like shape. The value of each CT measurement change between baseline and follow-up in predicting progression-free survival (PFS) was analysed by logistic regression and Cox proportional hazards regression model.
Results: Volumetric measurements were the most reproducible measurements. The only significant indicators of lower PFS were the volume change for two observers (greatest HR, 1.57; 95% CI: 1.04-2.38), and the maximal diameter obtained through the software for one observer (HR, 3.58; 95% CI: 1.18-10.9).
Conclusion: Our preliminary data suggests that the software-based assessment of the lesion size seems more reproducible than the manual one and of more prognostic value.

B-0657 11:15

Conflicting or complementary role of computed tomography (CT) and positron emission tomography (PET)/CT in the assessment of thymic cancer and thymoma

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Purpose: To evaluate the role of CT and PET/CT in thymic cancer and thymoma patients at initial staging.
Methods and Materials: We retrospectively reviewed CT and PET/CT of 26 patients with a proven-diagnosis of thymic cancer (n=9)and thymoma (n=17).Chest CT findings documented were qualitative (calcification, peritumoral fat infiltration,pleural-pericardial effusion, degree of abutment of vessel circumference, et al)and quantitative (maximum axial and longitudinal diameter and volume).Both qualitative and semiquantitative data (standardised uptake value, total lesion glicolysis-TLG, metabolic tumor volume-MTV)were recovered by PET/CT.The outcome of all patients was retrieved by clinical chart or observational follow-up.The comparisons among histological entities, outcome and CT and PET/CT findings were evaluated using a non-parametric analysis.
Results: PET/CT resulted positive in 15 patients with thymoma.100%of patients with thymic cancer had a positive scan.CT was available in 5/9 patients with thymic cancer and in 3/17 subjects with thymoma.All quantitative CT parameters were significantly higher in patients with thymic cancer than thymoma (MAD:45vs.20 mm,MLD:69vs.21 mm and volume:77.91vs.4.52 ml;all $p < 0.05$).Conversely, only MTV and TLG were significantly different in patients with thymic cancer than the counterpart (126.53vs.6.03 cm3 and 246.05vs.20.32,respectively;both $p < 0.05$).After a median follow-up of 17.45 months, four recurrences of disease occurred (three in patients with thymic cancer and one with a type B2 thymoma).Follow-up data were lost in three subjects.CT volume in a patient with recurrent disease was 170.12 ml vs. a median value of 10.5 ml in seven disease-free patients.MTV was higher in recurrent than disease-free subset (143.3vs.81.13 cm3),although not statistically significant (p=0.075).
Conclusion: Both morphological and metabolic volume can be useful for diagnostic and prognostic meaning in thymic cancer and thymoma patients.

B-0658 11:24

Posttransplantation lymphoproliferative disorder (PTLD) of the chest: CT and FDG-PET/CT features in twelve adults

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Purpose: To investigate chest CT and 18 F-FDG-PET/CT findings of posttransplantation lymphoproliferative disorder (PTLD) of the chest in adults.
Methods and Materials: This retrospective study was approved by the Institutional Review Board. Informed consent was waived. From November 2004 through February 2013, twelve patients (three female, nine male; age range, 34-68 years; median age, 46 years) were retrospectively reviewed who were histopathologically proved PTLD. Transplanted organs were kidney (n=6), liver (n=4), and heart, pancreas, bone marrow (n=1), respectively. We investigated the relationship with Epstein-Barr virus (EBV) infection and patients' outcomes. We evaluated the locations and characteristics of the imaging abnormalities on chest CT (n=12) and max SUV on 18 F-FDG-PET/CT scans (n=10). The lesions were classified into the following three patterns: 1) lymph node pattern; 2) pleural pattern; and 3) airspace pattern.
Results: The interval between transplantation and PTLD onset was 2-128 months (median, 49). EBV infection found in 10 patients (83%). Outcomes showed complete (n=8, 67%) or partial remission (n=3) and undetermined (n=1). The most common CT patterns were LN involvement in the mediastinal, supraclavicular, or axillary area (n=10, 83%). The other findings were pleural involvement as effusion (n=4, 33%), and airspace involvement; necrotic consolidative mass or nodules (n=3, 25%) with overlapped patterns in 5 cases. Max SUV on 18 F-FDG-PET/CT scans was 2.7~25.5 (median 7.7).
Conclusion: PTLD involving the chest manifests as three distinct patterns on LNs involvement, pleural effusion, and nodules or masses in order of frequency on chest CT. All patients proved lesions demonstrate increased FDG uptake on 18 F-FDG-PET/CT.

B-0659 11:33

Cardiac mortality and morbidity in breast cancer survivors after radiation therapy - is coronary atherosclerosis the culprit?

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Purpose: Breast cancer survivors after radiation therapy (RT) have increased rates of cardiac morbidity and mortality. We sought to investigate whether accelerated coronary artery disease (CAD) is to blame by comparing coronary calcium scores (CCS) in breast cancer survivors with and without RT.
Methods and Materials: 306 women with history of breast cancer were included. 67 patients underwent chest CT studies ≥6 months after the start of RT (RT-group), whilst 239 patients had a CT scan either prior to or without undergoing RT (noRT). Coronary calcium was quantified by applying a threshold-based automated algorithm using a dedicated workstation. Statistical analysis included the Fisher's exact test, Wilcoxon-Mann-Whitney Test, the Siegel-Tukey Test, and Cox-regression analysis.
Results: Mean age at diagnosis for the noRT group was 57.1±11.9 years versus 58.4±12.9 years for the RT group ($p > 0.05$). The groups showed no significant differences in race, smoking history, laterality, or cancer stage. 61 noRT patients (25.5%) had a CCS of 0, compared to 18 RT patients (26.9%, $p > 0.05$). The median CCS for both groups was 0 (25^{th}, 75^{th} percentile: 0, 4; $p > 0.05$). When adjusting for the time between diagnosis/RT and CT, RT patients had a significantly lower risk of a positive CCS compared to noRT patients. Results were similar after adjustment for age, race, smoking history, laterality and stage.
Conclusion: Breast cancer survivors after RT are not more likely to show coronary calcifications on subsequent CT imaging. Our preliminary results thus do not support radiation-induced accelerated CAD as an explanation for higher rates of heart disease in this group.
Author Disclosures:
U.J. Schoepf: Consultant; Bayer, Bracco, GE, and Siemens.

B-0660 11:42

Multidetector low-dose CT in assessment of predictive signs of malignancy of undetermined lung nodules in staging of patients with known lung cancer

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Purpose: To assess the role of low-dose multidetector computed tomography study in the evaluation of undetermined nodules identified on patients with lung cancer, referred to CT staging.
Methods and Materials: A total of 32 patients (22 males, 10 females; mean age 67.7 years, range 30-80) with known lung cancer and undetermined concomitant lung nodules were reviewed. All patients underwent multiple whole body CT scan examinations, with a minimum follow-up of 12 months. All studies were analysed in order to identify and characterise undetermined lung nodule (up to 3 cm in diameter) besides the primary lesion, according to their maximum axial diameter, density and structure.
Results: In 32 patients with lung cancer (31 NSCLC, 1 carcinoid) during a follow-up period of at least 12 months (range 12-87), a total of 221 nodules was found (mean 6.9 per patient, range 0-18). We classified 35/221 (15.8%) nodules in 17/32 patients as metastatic in relation to dimensional growth over time or decrease in size after treatment (mean diameter at staging CT of 6.05 mm, range 2.2-15.7 mm): 32/35 (91.4%) nodules were solid non-calcified; 2 (5.7%) non-solid and 1 (2.9%) partially solid. A total of 186/221 (84.2%) nodules was considered as benign (mean diameter 4.3 mm, range 1.8-14.1 mm): 140/186 nodules were solid non-calcified (75.3%), 19 (10.2%) non-solid, 3 (1.6%) partially solid and 24 (12.9%) calcified. No cut-off value in diameter was found to discriminate benign from malignant nodules.
Conclusion: The assessment of dimensional growth during follow-up period remains the most reliable method to establish malignant nature of undetermined nodules in lung cancer patients.

10:30 - 12:00 **Room E1**

Musculoskeletal

SS 1310

Cartilage and muscle: advanced imaging

Moderators:
J.S. Bauer; Munich/DE
L. Cerezal; Santander/ES

B-0661 10:30

MR T1rho quantification of knee cartilage lesion: correlated with arthroscopic evaluation

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Purpose: To evaluate the capability of T1rho quantification identifying knee cartilage lesion confirmed by arthroscopy.
Methods and Materials: 31 patients and 72 healthy controls were scanned at 3.0 Tesla. 38 cartilage lesions in 31 patients were found by arthroscopy. WORMS was used for clinical MRI grading. T1rho value and z-scores value (T1rho normalised to control values in matched regions) in full thickness, deep and superficial layer cartilage were compared between compartments with and without lesions. Student t-test was compared of WORMS, T1rho and Z-score value between normal cartilage and cartilage lesion. ROC analysis was compared the specificity and sensitivity of the three quantitative methods.
Results: Compared to compartment without lesions, all of WORMS, T1rho and z-score values of cartilage significantly increased at the compartments with lesions ($p < 0.01$). The AUC were 0.734 (95% CI: 0.64, 0.83), 0.746 (0.64, 0.85) and 0.775 (0.69, 0.86) among the WORMS, T1rho value and z-score quantification separately. The AUC of the full thickness, deep and superficial layer cartilage of z-score value were 0.775 (95% CI: 0.69, 0.86) 0.654 (0.54, 0.76), and 0.784 (0.68, 0.89) respectively.
Conclusion: T1rho quantification show a better diagnostic capability compared clinical MRI grading in detecting cartilage lesion, especially when using normalised z-score and laminar analysis.

B-0662 10:39

Delayed gadolinium-enhanced MRI of cartilage is superior to T1rho-mapping in measuring cartilage-sulphated glycosaminoglycan content: preliminary results of an in vivo validation study

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Purpose: T1rho-mapping has been proposed as a non-contrast-enhanced alternative to delayed gadolinium-enhanced MRI of cartilage (dGEMRIC) to quantitatively measure cartilage-sulphated glycosaminoglycan (sGAG) content. However, no thorough validation studies comparing both techniques acquired in vivo against a tissue reference standard for sGAG have been performed. The aim of this study was to assess the relation of dGEMRIC and T1rho-mapping with cartilage sGAG content in vivo in osteoarthritis patients.
Methods and Materials: We analysed data of 8 patients from an ongoing study in which knee osteoarthritis patients undergo T1rho-mapping and dGEMRIC at 3 T before total knee replacement (TKR). T1- and T1rho-values of both scans were calculated in 6 cartilage regions (medial and lateral weight-bearing (WB) femoral condyles and tibial plateaus and non-WB cartilage of the condyles). Femoral and tibial cartilage was harvested during TKR and rescanned with contrast-enhanced microCT (CE-uCT), which served as reference standard for sGAG since it has been shown to accurately measure sGAG content. We analysed the correlation between T1- and T1rho-values and CE-uCT outcomes with linear regression.
Results: T1- and T1rho-values ranged between 280-834 ms and 32-48 ms, respectively, for dGEMRIC and T1rho-mapping. dGEMRIC outcomes had a strong negative correlation with CE-uCT ($r=-0.78$;$p < 0.0001$;95%CI=-0.88--0.63), while T1rho outcomes did not correlate with cartilage sGAG content ($r=-0.01$;$p=0.94$; 95%CI=-0.35--0.32).
Conclusion: Our preliminary results suggest that dGEMRIC can accurately measure articular cartilage sGAG content, whereas T1rho-mapping is not suitable for this purpose. Therefore, despite the need to use a contrast agent, we consider dGEMRIC to be superior to T1rho-mapping for quantitatively measuring cartilage sGAG content.
Author Disclosures:
G.P. Krestin: Consultant; General Electric Healthcare. Grant Recipient; General Electric Healthcare.

B-0663 10:48

CT arthrography of the human knee to quantitatively measure cartilage biochemical composition: preliminary results of an in vivo validation study

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Purpose: The ability of CT arthrography (CTa) to quantitatively measure human cadaveric knee cartilage composition in terms of sulphated glycosaminoglycan (sGAG) content has recently been demonstrated. Since a validation study comparing in vivo acquired CTa outcomes against reference standards for cartilage composition has not been performed yet, the aim of the present study was to perform such a validation in humans with knee osteoarthritis (OA).
Methods and Materials: We analysed data of 8 patients from an ongoing study in which knee OA patients (Kellgren and Lawrence grade 2-4) undergo CTa before total knee replacement (TKR). Mean X-ray attenuation values were calculated in 6 regions of interest (ROI) of the articular cartilage (medial and lateral weight-bearing (WB) femoral condyles and tibial plateaus and non-WB cartilage of the condyles). Femoral and tibial cartilage was harvested during TKR and rescanned with contrast-enhanced microCT (CE-uCT), which served as surrogate reference standard for sGAG since it has been shown to accurately measure sGAG content. We analysed the correlation between CTa X-ray attenuation and CE-uCT outcomes with linear regression.
Results: X-ray attenuation values of the different ROIs in the tibiofemoral joint ranged from 150 to 450 Hounsfield Units. Outcomes of CTa had a strong correlation with reference CE-uCT, representing sGAG content of cartilage ($r=0.81$;< 0.0001;$r^2=0.65$).
Conclusion: Our preliminary results suggest that CTa can accurately measure sGAG content of articular cartilage in human knee joints in vivo. The coefficient of determination, however, is only moderate and therefore CTa outcomes are likely to be also influenced other composites of cartilage, e.g. collagen.
Author Disclosures:
G.P. Krestin: Consultant; General Electric Healthcare. Grant Recipient; General Electric Healthcare.

B-0664 10:57

Biochemical imaging and morphological analysis of the lower extremity joint cartilages of 44 ultra-marathoners with a mobile MRI during a 4500 km trans-continental-run

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Purpose: The TransEuropeFootRace (TEFR) was one of the longest ultra-marathons. The results on investigations on the cartilage layers of the lower extremity joints are shown in the progress of the TEFR, proofing the hypothesis, that running nearly 4,500 km alters the joint cartilage in an extent towards relevant cartilage injury improving the risk of osteoarthritis.
Methods and Materials: 44 TEFR-participants were accompanied by a mobile 1.5 T MR-imager mounted on a 40-tonnes truck, when running 70.1 km per stage in 64 days. They got repeated MRI on knee, ankle and midtarsal joints in regular intervals. The protocols used were a TIRM, a PDw TSE fs and a T2*

GRE mapping sequence. ROIs were selected manually on T2* images. Morphological evaluation was done on the PDw and TIRM sequences.
Results: Compared to start, there are significant increases of mean T2* values detectable in all cartilage layers of all evaluated joints (except: femoropatellar joint) for all measurement intervals during the TEFR ($p < 0.05$). We found relevant decreasing of mean T2*values in the cartilages of joints with axial loading after 2,000 km distance run. No relevant changes regarding morphological criteria like thickness of cartilage layers were seen for any of the investigated joints.
Conclusion: It could be shown for the first time in vivo that after early degradation human cartilage matrix is able to develop anabolic changes with de novo re-synthesis of glycosaminoglycanes under ongoing multistage ultramarathon burden in axial loaded lower extremity joints. Therefore, there is no distance limit in running regarding human joint cartilages.

B-0665 11:06

Quantitative MR imaging of the ankle: the effect of axial traction on cartilage T2 relaxation times and cartilage diffusion values

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Purpose: To assess the impact of axial traction during 3.0 T MR imaging of the ankle on quantitative cartilage imaging parameters.
Methods and Materials: Ankle MR images were acquired in 8 volunteers with and without axial traction (6 kg). For morphological evaluation, coronal and sagittal T1-weighted (w) turbo spin echo (TSE) sequences with a DRIVE pulse, sagittal fat-saturated intermediate-w TSE sequences and 3D gradient echo sequences were acquired. For quantitative assessment of cartilage degradation, segmentation was performed on three different sagittal sequences: 2D multislice-multiecho (MSME) SE T2-w, steady-state free-precession (SSFP) T2-w and SSFP diffusion-weighted imaging (DWI). Paired t-tests were used for statistical analysis. Coefficients of variation (CV) were calculated to assess reliability of two independent observers.
Results: Cartilage surface delineation was superior with axial traction ($P < 0.05$), especially on coronal T1-w images. T2 differed significantly with and without axial traction (tibia, P=0.016; talus, P=0.007). While without traction, tibial and talar T2 was not significantly different (mean±SEM, 43.5±1.6 ms versus 44.1±0.9 ms, P=0.658), with axial traction, T2 was lower at the tibia (40.0±1.6 ms versus 46.1±1.0 ms, $P < 0.001$). SSFP T2 was significantly different between tibia and talus in MR scans with axial traction (20.3±1.7 ms versus 24.5±1.0 ms; P=0.005; normal scans, P=0.289). SSFP DWI values at the talus differed significantly (P=0.035). Reproducibility was better for images with axial traction (tibia T2, CV, intrareader 1.5% and 1.7% versus 1.7% and 3.7%, interreader 3.4% versus 5.2%).
Conclusion: Axial traction of the ankle during MR imaging better visualised the cartilage surface, improved compartment discrimination and reproducibility of quantitative cartilage matrix degradation parameters.

B-0666 11:15

Longitudinal follow-up of changes regarding specific body tissue composition of 44 ultra-marathoners with a mobile whole body MRI during a 4,500 km trans-continental-run

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Purpose: The results of differentiated measurements of changes in body composition during the TranseuropeFootrace (TEFR) using a mobile whole-body MR-imager are presented and the proposed influence of visceral and somatic adipose and lean tissue distribution on performance tested.
Methods and Materials: 22 participants were randomly selected for the repeated MR-measurements (intervals: 800 km) with a mobile 1.5 Tesla MR scanner mounted on 40-tons truck during the 64-stage 4,486 km TEFR. A validated MRI protocol was used: T1w TSE, TE 12 ms, TR 490 ms, ST 10 mm, SD 10 mm. For topographic tissue, segmentation and mapping a modified fuzzy c-means algorithm was used. A semiautomatic postprocessing of whole body MRI datasets allows reliable analysis of the following tissue compartments: Total, somatic and visceral adipose (TAT,SAST,VAT) and lean (TLT,SLT,VLT) tissue. Adipose and lean tissue was also differentiated regarding trunk and extremities.
Results: Adipose tissue showed a significant decrease at all measurement times for TAT, SAST and VAT. Lean tissues decreased until the end of the race, but not significantly. The mean relative volume changes at the last measurement compared to the start were: TAT−41.3%, SAST−48.7%, VAT−64.5%, intraabdominal adipose tissue −67.3%, mediastinal adipose tissue −41.5%, TLT−1.2%, SLT−1.4%.
Conclusion: Even lean tissue volume (mainly skeletal muscle) decreased due to the unpreventable chronic negative energy balance during TEFR. VAT has the fastest and highest decrease compared to SAST and lean tissue compartments during the race. It seems to be the most sensitive morphometric parameter regarding the risk of non-finishing a transcontinental ultramarathon and shows direct relationship to prerace-performance.

B-0667 11:24

Correlation between muscle cross-sectional area measurement and total vastus medialis volume in patients with anterior cruciate ligament reconstructions

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Purpose: Vastus medialis atrophy is a clinical indicator for postoperative knee function in patients with anterior cruciate ligament (ACL) reconstructions. Purpose was to develop a simple estimation for total muscle volume in patients with ACL-reconstructions.
Methods and Materials: Prospective IRB approved study with written informed patient consent. Both thighs of thirty-four consecutive patients with ACL-reconstructions (men, 22; women, 12) were imaged at 1.5 T using an axial T1-weighted as well as axial 3D spoiled dual gradient-echo (LAVA FLEX) sequences with automated reconstruction of pure fat-only and water-only images. Total muscle volume of both vastus medialis muscles (n=68) was determined by one experienced reader on the water-only images, where muscle borders were more clearly identifiable, using dedicated software featuring semi-automatic segmentation with linear interpolation (Myrian 1, Intrasense, France). In addition, the muscle`s cross-sectional area was measured on single slices at two different levels, 15 cm (CSA-Up) and 6 cm (CSA-Low) above the knee joint. The correlation between total muscle volume and both cross-sectional area measurements was evaluated using Pearson correlation-coefficient. $p < .05$ indicated statistical significance.
Results: The vastus medialis' total muscle volume was 457.2±132.6 cm3 (mean±SD)(range, 197.3-771.2). The mean±SD CSA-Up was 2405.2±664.4 mm2 (range, 1241-3969) and the mean±SD CSA-Low was 1211.7±416.4 mm2 (range, 431-2199). Pearson correlation showed a weak linear relationship between total muscle volume and CSA-Low (r=.347, p=0.002), but a strong linear relationship between total muscle volume and CSA-Up (r=.949, $p < .001$).
Conclusion: Muscle cross-sectional area measurements 15 cm above the knee joint allow simple estimations of the total vastus medialis muscle volume.

B-0668 11:33

MRI muscle fat quantification with 3 point Dixon in 20 patients with muscular dystrophy and its correlation with clinical scales

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Purpose: Muscle magnetic resonance imaging (MRI) provides information on the distribution and evolution of limb girdle muscular dystrophies (LGMD). In the last years quantitative sequences like 3-point Dixon technique have been developed to measure muscle fat fraction.
The aim of this study is to quantify muscle fat content in lower limb muscles of ambulant patients with LGMD 2 A and to determine its correlation with functional scales.
Methods and Materials: Cross-sectional study of 20 ambulant patients with molecularly confirmed LGMD2 A. Gardner-Meldwin-Walton and Vignos scales were assessed by a neurologist to determine clinical severity. A 3-point Dixon sequence (TE 2.3-4.6-6.9 ms, FOV 375, matrix 376/384, thickness 2 mm, acquisition time: 5.10 minutes) was performed in a 1.5 T Achieva Philips scanner. Muscle fat fraction was calculated drawing a region of interest covering cross-sectional area in three different slices per muscle bilaterally (ten muscles in thigh, eight in calves). Correlations between clinical scales and muscle fat fraction were determined with Spearman's rho coefficient.
Results: Mean age was 24.30 ± 9.35 years. Mean clinical severity was 4.65 ± 2 and 3.68 ± 1.87 in Gardner-Meldwin-Walton and Vignos scales. A significant correlation ($p < 0.05$) was detected between the mean fat muscle content of all muscles and Gardner-Meldwin-Walton (r-square 0.91) and Vignos (r-square 0.86) scale. This correlation was also found separately in the muscles of thigh (r-square 0.9) and calves (r-square 0.86).
Conclusion: Muscle fat content measured with 3-point Dixon provides a high correlation with clinical severity of ambulant LGMD2 A patients and could be a useful biomarker.
Author Disclosures:
R. Fernández-Torron: Grant Recipient; Rio Hortega Grant, Ministry of Health and Science. Research/Grant Support; SAIOTEK programme of Basque Government.

B-0669 11:42

Real-time elastosonography RTE contribution in assessing muscle spasticity in patients with spinal cord injury: preliminary report

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Purpose: This study aims to present our experience of 9 cases of spinal cord injury patients (SCI), using ultrasonography and real-time elastosonography (RTE) in assessing muscle spasticity versus fibrotic muscle component.
Methods and Materials: We examinates 9 patients with incomplete (2 patients) or complete (5 patientes) SCI, 2 women, 7 men using an ultrasound system with array tranducer F-75 Aloka Hitachi UST-5411, 2-18 MHz. We investigated intrinsic stiffness changes using RTE in the triceps sural muscle: the relaxed muscle structures appear mostly soft (yellow-red), while contracted or degenerated muscle fibers appear hard (blue). Elastosonography findings were converted in a semiquantitative measurement method (ratio) from 0 to 4 (increase stiffness to reduce stiffness respectively) between the area of interest and a reference area in our case standoff pad. Clinical and functional evaluations were performed (ROM, Ashworth scale, WHS). Statistical analysis included Pearson r calculation, and regression line analysis.
Results: We observed, throughout statistical analysis, an opposite correlation (r= -0.595) between clinical data of ROM evaluation and RTE value of muscle flexibility ($y = -0.039x + 4.902$ $R^2 = 0.354$).
Conclusion: The muscle flexibility is an important component to quantify grade of spasticity in SCI patients. In this preliminary report, a decreased ROM matches with an increased ratio (mostly soft muscle). It could be a fundamental component to choose the best treatment for this typology of patients. For a better evaluation of muscle component (spastic or fibrotic) we need to continue with a more representative and homogeneous sample.

B-0670 11:51

T1rho values and T2 mapping using 3.0-Tesla MRI and arthroscopic findings correlations of hip joint cartilage in patients with early osteoarthritis caused by femoroacetabular impingement (FAI)

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Purpose: The aim of this study was to examine correlations among the pain score, the hip arthroscopic findings and to evaluate the sensitivity of T1rho and T2 mapping in the quantification of early damaged hip joint cartilage in FAI patients.
Methods and Materials: Twenteen patients with clinical signs of FAI (5 cam-type and 7 mixed-type) were examined using 3.0-T magnetic resonance imaging (MRI). T2 mapping and T1rho values were calculated from sagittal-oriented gradient-multi-echo sequences. Region of interest analysis was manually performed on consecutive slices. Median T2 mapping values and T1rho values of both the superior damaged cartilage areas were compared. In addition, all patients underwent hip arthroscopy, and the Multicenter Arthroscopy of the Hip Outcomes Research Network (MAHORN) score were calculated and compared with T1rho and T2 mapping. The significance of differences between the T1rho values and the T2 mapping of cartilage were determined using a paired *t*-test and non-parametric regression analysis. P values < 0.05 were considered statistically significant.
Results: The pain score was significantly correlated with T1rho values (r=0.96, $*p < 0.01$) but no significant correlation was observed with T2 mapping (r=-0.12,p=0.67). The cartilage delamination of MAHORN score was significantly correlated with T1rho values (normal cartilage vs injure cartilage; 85.22 vs 102.42, *p=0.02) but no significant correlation was observed with T2 mapping (46.64 vs 50.10, p=0.78).
Conclusion: T1rho has the potential to evaluate the degree of degeneration of hip joint cartilage in patients with early osteoarthritis caused by FAI.

10:30 - 12:00 **Room E2**

Abdominal Viscera

SS 1301

Advanced imaging of liver neoplasms

Moderators:
L.S. Guimaraes; Porto/PT
M. Laniado; Dresden/DE

B-0671 10:30

Using gadoxetic acid-enhanced liver MR imaging to predict histologic features and treatment response in liver metastasis from breast cancer: Preliminary results

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Purpose: To retrospectively identify gadoxetic acid-enhanced MRI findings of liver metastasis from breast cancer that correlate with histologic factors of breast cancer, and to evaluate the relationship between MRI findings and treatment response.
Methods and Materials: This study was approved by our institutional review board and the requirement for informed consent was waived. Thirty-four metastatic lesions of 20 breast cancer patients with liver metastasis were included. Appearance on hepatobiliary phase (HBP) and T2WI, and arterial enhancement pattern were evaluated.
Histologic factors including histologic subtype (luminal A, luminal B, HER2, and basal-like subtypes), mutation of p53, Ki67 labeling index, and tumor grade of breast cancer were reviewed and analysed to identify histologic factors that correlate with MRI findings.
In 11 patients who had undergone chemotherapy for liver metastasis, sixteen metastatic lesions were classified into "responder" and "non-responder", and also analysed to evaluate correlation between treatment response and MRI findings.
ADC value and lesion-to-liver SI ratio were measured for each lesion and compared between different groups.
Results: There was no histologic factor that significantly correlated with gadoxetic acid-enhanced MRI findings, and ADC value and SI ratio did not correlate with any histologic factors. "Target" appearance on HBP was more frequent in "non-responder" than "responder"[11/12 (91.7%) vs. 1/4 (25%), p=0.027]. ADC value and SI ratio were not significantly different between "responder" and "non-responder"(1.13 ± 0.21 vs.$1.02\pm0.19\times10^{-3}$ mm^2/sec, p=0.396, and 0.51 ± 0.13 vs.0.55 ± 0.14, p=0.865, respectively).
Conclusion: Metastatic lesions from breast cancer showing "non-target" appearance on HBP of gadoxetic acid-enhanced MRI tend to respond better to chemotherapy than those showing "target" appearance.

B-0672 10:39

Assessment of response to chemotherapy in patients with liver metastases from colorectal cancer: value of diffusion-weighted MR imaging

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Purpose: To evaluate diffusion-weighted MR imaging (DWI) in assessing response to chemotherapy in patients with liver metastases from colorectal cancer.
Methods and Materials: Thirty-three patients (24 men, 9 women, mean age 65.5 years) with liver metastases from colorectal cancer underwent MR imaging (1.5 T Magnetom Avanto, Siemens) before and after 8 weeks of systemic chemotherapy. The MR imaging protocol comprised DWI using a single-shot echo-planar imaging sequence (TR = ∞TE =69 ms, Matrix 192x144, slice thickness 5 mm, iPAT factor = 2, b values 50, 300 und 600 s/mm²) combined with navigator echo technique. ADC (apparent diffusion coefficient)-values of metastases were calculated before and after chemotherapy. Regions of interest entailed (a) the whole lesion and (b) the periphery of lesions. Response of metastases to chemotherapy was assessed using the Response Evaluation Criteria in Solid Tumors.
Results: One-hundred-four metastases (72 responding and 32 non-responding) were analysed using DWI. Responding (1.28 vs. 1.41) and non-responding lesions (1.4 vs.1.46) had higher ADC-values after chemotherapy using whole tumor regions of interest; these were only significant in responding lesions (p = 0.001; nonresponding lesions p =0.21). ADC-values in the periphery of metastases showed a significant increase in responding lesions (1.01 vs. 1.20; p = 0.0116). ADC value increase of nonresponding lesions was not significant (1.07 vs.1.16 p = 0.4586).
Conclusion: Following chemotherapy, responding lesions showed a significant increase of ADC values when measured as a whole region of

interest and also when measured in the periphery. Nonresponding lesions did not show a significant difference.

B-0673 10:48

Liver lesion margin intensity slope to distinguish cysts, responder and non-responder colorectal metastases following anti-angiogenic therapy

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Purpose: To evaluate liver margin intensity slope (LMIS)as a potential imaging biomarker for distinguishing responder and non-responder colorectal liver metastases from cysts after anti-angiogenic therapy.
Methods and Materials: The HIPAA compliant study was IRB approved. Two patient cohorts were selected. First cohort comprised of 45 colorectal liver metastases in 21 patients treated with bevacizumab with post-treatment abdominal CT and a FDG-PET scans. Second cohort comprised of fifteen patients with 19 liver cysts imaged by contrast-enhanced MDCT. Volumetric segmentation of liver lesions was performed using semiautomated segmentation software. Lesion margin intensity slope, a quantitative measure of margin sharpness, where sharper margins of low-density lesion result in greater negative value, was measured for liver metastases and cysts. LMIS of post-treatment liver metastases was compared with their FDG-PET response and with LMIS of cysts. One-way analysis of variance was used for initial analysis with Student-Newman-Keuls test for multiple comparisons.
Results: Based on FDG-PET 34/45 (75.5%) lesions showed response and 11/45 (24.4%) lesions were nonresponders. Mean LMIS values for nonresponders, responders and liver cysts were - 8.2 ± 4.3, - 19 ± 3.4 and - 22.27 ± 4.8 HU/layer, respectively ($p < 0.0001$). On multiple comparisons, all three groups were significantly different from each other though, responder lesions had less mean difference in LMIS value from cysts when compared with nonresponders (11.52 HU/layer for responders vs. 18.9 HU/layer for nonresponders).
Conclusion: Integration of LMIS may help differentiate liver cysts from metastases. It is a potential biomarker of response to antiangiogenic treatment in colorectal liver metastases.
Author Disclosures:
A.R. Seyal: Research/Grant Support; Educational Grant Support from Siemens Healthcare. **F.D. Gonzalez-Guindalini:** None. **K. Parekh:** Research/Grant Support; Educational Grant Support from Siemens Healthcare. **Y. Velichko:** None. **T. O'Donnell:** Employee; Siemens Medical Solutions.

B-0674 10:57

Dyna-CT vs MDCT in the evaluation and detection of hypervascular HCC

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Purpose: To evaluate the feasibility and the reproducibility of Dyna-CT in the evaluation of the contrast-to-noise ratio compared with MultiDetector-Computed Tomography (MDCT).
Methods and Materials: Twenty consecutive cirrhotic patients, scheduled for transarterialchemoembolisation-(TACE), planned on the basis of MDCT, underwent Dyna-CT immediately before treatment. 64-slice CT was performed with 0.6×64 mm collimation, 3-mm section thickness, 250 mAs, 120 kVp. A triple-phase protocol was utilised with scans initiated at 18s, 60s and 180s after a trigger threshold of 150 HU above baseline was achieved in aorta. Dyna-CT was performed after having positioned a Sim-1 catheter beyond the gastroduodenal artery. Injection rate and volume of contrast media were left to the operator choice according to vascular anatomy. The contrant agent was diluted up to 40% with saline. Intra-arterial injection lasted 12 sec (4 sec delay +8 sec of acquisition).Two radiologist in consensus evaluated two data sets of images on a dedicated workstation (Leonardo; Siemens Medical Systems).The mean CT numbers of HCC nodules were assessed by manually placing circular or ovoid ROIs, which were drawn to encompass as much of the lesion as possible. CNR was calculated for both technique as follow: ROIt - ROIl/ SDn where ROIt is the mean attenuation of the tumor, ROIl is the mean attenuation of the non-tumorous liver parenchyma, and SDn is the image noise.
Results: No statistical significant difference was reported between MDCT and Dyna-CT in the evaluation of HCC's CNR ($p>.05$).
Conclusion: Dyna-CT is feasible and reproducible compared to MDCT in the assessment of hypervascular HCC.

B-0675 11:06

Volumetric assessment by 7 Tesla liver magnetic resonance (MR) in mice to evaluate a novel therapy for colorectal cancer (CRC) metastases

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Purpose: Tie2-expressing monocytes (TEMs) are tumor-associated macrophages with pro-angiogenic activity, normally recruited in primitive and metastatic liver lesions with neo-angiogenesis. As interferon-α (IFNα) is known to play antitumoral effects, we engineered TEMs to express and selectively deliver IFNα to liver metastases. Antitumoral efficacy was assessed by MRI volumetric analyses in a mouse model of liver CRC metastases.
Methods and Materials: Liver metastases were induced injecting $5x10^3$ CT26-GFP cells through the splenic vein in 30 CB6 F1 mice: 14/26 were previously transplanted with TEMs engineered to express IFNα under the Tie2 promoter (IFN-group); 12/26 were transplanted with engineered TEMs expressing green-fluorescent-protein under the Tie2 promoter (Placebo-group); 4/26 control mice were not manipulated before metastases induction (Control-group). At 14-21-34 and 54 days all mice underwent in-vivo 7-Tesla liver-MRI with hepatocyte-specific contrast agent (EOB-DTPA) for the volumetric assessment of metastases.
Results: The incidence of liver metastases was lower in IFN-group than in Placebo and Control groups both at 14 (0%vs57%vs50%; $p < 0.05$) and at 34 days (11%vs100%vs100%; $p=0.002$) from CT26-GFP cells injection. 3 IFN-mice that developed metastases at day 21 were cured and presented no metastases at day 54. Average tumor volume was significantly lower in IFN-group than in Placebo and Control groups with a mean value between time-points respectively of 1.53vs128.86vs38.92 mm^3 ($p < 0.01$). At day 54 all Placebo- and Control-mice were dead vs only 11% of IFN-mice ($p=0.001$).
Conclusion: Hepatic deliver of IFNα by engineered TEMs reduces the incidence and volume of CRC metastases at serial MRI analyses and improves survival in experimental mice.

B-0676 11:15

Preoperative assessment of colorectal liver metastases after chemotherapy: a combined approach of diffusion-weighted MR imaging with b-multiple SE-EPI and Gd-EOB-DTPA MR sequences at 3 T-device

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Purpose: To determine whether diffusion-weighted MR imaging (DW-MRI) with b-multiple SE-EPI could improve the diagnostic performance of Gd-EOB-DTPA-enhanced MRI (dynamic and hepato-biliary phase sequences) in the preoperative assessment of colorectal liver metastases in patients previously undergone chemotherapy.
Methods and Materials: Twenty patients with colorectal cancer and focal liver lesions underwent MR imaging at 3 T-device (GE DISCOVERY MR750;GE Healthcare) after preoperative chemotherapy. Three images sets were separately reviewed by two observers in conference: 1, DW-MRI using a spin-echo echo-planar sequence with multiple b values (150, 500, 1000, 1500 sec/mm²); 2, Gd-EOB-DTPA Lava-flex sequence including both dynamic and hepato-biliary phase; 3, combined DW-MRI and Gd-EOB-DTPA images. The MRI findings were correlated with surgery and histopathology, which was our gold standard. Only clear benign lesions at intraoperative ultrasound remained unresected. Statistical analysis was performed on a per-lesion basis.
Results: A total of 146 hepatic lesions were detected; of these, 106 were metastases (72.6%), whereas the remaining 40 (27.4%) were characterised as benign lesions (cysts and hemangiomas). Image set 1 correctly identified 92 out of 106 metastases (sensitivity 86.7%, specificity 50%, diagnostic accuracy 76.7%), image set 2 correctly detected 98 out of 106 metastases (sensitivity 92.4%, specificity 70%, diagnostic accuracy 86.3%), and image set 3 correctly diagnosed 104 out of 106 metastases (sensitivity 98.1%, specificity 95%, diagnostic accuracy 97.2%). Differences were statistically significant ($p < 0.001$).
Conclusion: DW-MRI with b-multiple SE-EPI significantly increases the diagnostic performance of Gd-EOB-DTPA-enhanced 3 T MRI in the preoperative assessment of colorectal liver metastases.

B-0677 11:24

Performance of gadoxetic acid-enhanced MRI for the differentiation of FNH and HCA: a single centre experience

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Purpose: Evaluation of enhancement characteristics of focal nodular hyperplasia (FNHs) and hepatocellular adenomas (HCAs) with gadoxetic acid-enhanced magnetic resonance imaging (MRI).
Methods and Materials: Eighty-six patients who underwent MRI at 1.5 T were retrospectively included. Examination protocol contained: T1-in- and opposed phase; T2-weighted UTSE and fat-saturated T1-weighted (WATS; LAVA) with and without contrast media (Gd-EOB-DTPA; arterial, portal venous, venous and hepatobiliary phase. Standard of reference was surgical resection (n=53) or biopsy (n=15) available for 114 lesions. All cases were read by two independent radiologists in consensus. Lesion intensity was visually compared with the intensity of the surrounding liver parenchyma. Furthermore, relative signal intensity (SI) values (%) in contrast to native SI values were recorded for the different contrast phases.
Results: 114 lesions (FNHs, n=44; HCAs, n=70) were evaluated. On unenhanced MRI, presence of fat ($P < 0.001$; accuracy=54%), haemorrhage ($P=0.071$; accuracy=57%) and "wash-out" were indicative for HCA ($P < 0.001$; accuracy=63%), whereas the presence of a central scar was indicative for FNH ($P < 0.001$; accuracy=85%). Regarding signal intensities on hepatobiliary phase images, an iso-/hyperintense appearance of FNHs and hypointensity of HCAs were the best discriminators between both entities ($P < 0.001$; acc=92%).
Conclusion: An iso-/hyperintensity of FNHs and hypointensity of HCAs on hepatobiliary phase images are highly accurate discriminators between both entities. In case of conclusive findings of FNH on gadoxetic-enhanced MRI, biopsy may be dispensable.

B-0678 11:33

Evaluation of HCC and hypovascular nodules with gadoxetic acid-enhanced MRI and DWI

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Rome/IT

Purpose: To investigate the prognostic value of Diffusion Weighted imaging (DWI) compared to Gadoxetic Acid-enhanced MRI (Gd-EOB-DTPA enhanced MRI) both in the detection of HCC and hypovascular nodules hypointense on hepatobiliary phase images (HP), and in the assessment of its evolution.
Methods and Materials: Fifty-five patients underwent Gd-EOB-DTPA enhanced MRI including DWI sequences (b-values 50-400-800 s/mm²). We evaluated nodules size, vascular pattern on dynamic contrast-enhanced MRI and the signal intensity on HP and on DWI. Statistical differences in the detection of HCC according to the size were compared by McNemar test. Fisher's exact test was performed to analyse relationship between size of the hypovascular nodules and development of the hypervascularisation.
Results: One hundred and five nodules were detected with Gd-EOB-DTPA-enhanced MRI. Sixty-five/105 nodules showed typical vascular pattern of HCC on dynamic imaging; 63/65 lesions (96.9%) appeared hypointense on HP, 35/65 HCCs (53.8%) were hyperintense on DWI at b=800 s/mm². Thirty-nine/105 hypovascular nodules appeared hypointense in the hepatobiliary phase images. On follow-up MR images 18/39 nodules (46%) showed a typical vascular pattern of HCC (high risk ≥ 10 mm in size p=0.012). Nine/39 (23%) hypovascular nodules showed hyperintensity on DWI at the first exam, 7 of these developed into HCC during the follow-up period.
Conclusion: Gd-EOB-enhanced-MRI demonstrated highly accuracy in the diagnosis of HCC and in the detection of hypovascular nodules with potential progression to HCC.No significant add value of DWI compared to Gd-EOB-DTPA enhanced MRI was demonstrated, nevertheless hyperintensity of hypovascular nodules on high-b-value DWI seems to suggest high risk of malignant transformation

B-0679 11:42

Hepatocellular carcinoma: correlation between microvascular invasion with image findings of gadoxetic acid-enhanced MR and [^{18}F] FDG uptake on PET/CT

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Purpose: To analyse the correlation between microvascular invasion (MVI) with image findings of gadoxetic acid-enhanced MR and [^{18}F] FDG uptake on PET/CT in patients with hepatocellular carcinoma (HCC) who are undergoing liver transplantation.
Methods and Materials: 51 patients with 78 HCCs underwent liver transplantation after MR imaging and [^{18}F] FDG-PET/CT. Tumor size, signal intensity and homogeneity on dynamic phase and hepatobiliary phase (HBP), tumor margin, peritumoral enhancement, tumor capsule and peritumoral hypointensity were analysed. To evaluate 18 F-FDG uptake, the SUVmax of tumor, the ratio of tumor SUVmax to normal-liver SUVmax (TSUVmax/LSUVmax), and the ratio of tumor SUVmax to normal-liver SUVmean (TSUVmax/LSUVmean) were analysed. The size, histologic grades, the presence of MVI of the HCCs were evaluated on pathologic examinations. Association between the imaging findings with MVI were assessed by Fisher's exact test and logistic regression analysis. Independent t-test or Mann-Whitney test were used to compare continuous variables between the positive and negative MVI groups.
Results: Inhomogeneity on HBP (Odds ratio [OR] = 3.57, p =.032) and irregular margin (OR = 3.1, p=.035) were predictable factors for MVI. SUVmax (MVI positive: 5.09 ± 2.39, negative 3.27 ± 1.41, p =.001), TSUVmax/LSUVmax (positive: 1.59 ± 1.53, negative 0.81 ± 0.57, p =.007), and TSUVmax/LSUVmean (positive: 1.41 ± 1.28, negative 0.77 ± 0.54, p =.008) were significantly higher in positive MVI groups.
Conclusion: Irregular margin, inhomogenity on HBP of MRI and increased 18 F-FDG uptake on PET are factors that suggest MVI in HCC patients.

B-0680 11:51

Diagnosing MRI and CT in patients with colorectal liver metastases: diagnostic performance and inter-observer agreement of four different qualified reviewers

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Purpose: To compare the diagnostic performance of four different qualified reviewers retrospectively diagnosing CT and MRI of patients with colorectal liver metastases (CRLM).
Methods and Materials: 51 CT and 54 MRI of 105 patients with CRLM prior to hepatectomy were included. Segments were identified as CRLM positive or negative using intraoperative findings/histopathology and served as the reference standard for a per-segment analysis. Four reviewers of varied experience; (A,B,C: radiologists with respectively > 20, > 5, < 1 years of experience and D: 5th year medical student) reported the frequency of CRLM and the segments affected. Per-segment sensitivity, specificity, Cohens Kappa (κ) for diagnosed segments and intra-class correlation coefficients (ICC) for number of lesions were calculated.
Results: CT sensitivity and specificity was for reviewer A 89.71%/94.41%, B 78.50%/88.37%, C 63.55%/85.58% and D 84.11%/78.60%. MRI sensitivity and specificity was for reviewer A 90.40%/95.43%, B 74.40%/90.04%, C 60.00%/85.89% and D 65.60%/75.90%. In the analysis of diagnosed segments (κ) and frequency of CRLM per patient (ICC), the overall inter-observer agreement was higher for CT ($\kappa=0.43$, $p < 0.001$; ICC=0.75, $p < 0.001$) than MRI ($\kappa=0.38$, $p < 0.001$; ICC= 0.65, $p < 0.001$). The experienced reviewers A and B achieved better agreement for MRI ($\kappa=0.54$, $p < 0.001$; ICC =0.77, $p < 0.001$) than CT ($\kappa=0.52$, $p < 0.00$; ICC=0.76, $p < 0.001$) unlike the less experienced (MRI $\kappa=0.38$, ICC=0.63 and CT $\kappa=0.41$, ICC=0.74, respectively, $p < 0.001$).
Conclusion: MRI diagnosis of CRLM should be reserved primarily for expert radiologists. When compared to experienced radiologists, beginners can achieve better diagnostic performance with CT than MRI.

10:30 - 12:00 **Room F1**

Radiographers

SS 1314

Optimisation of imaging examinations

Moderators:
J.-F. Chateil; Bordeaux/FR
F. Zarb; Msida/MT

B-0681 10:30

Ventricular function assessment using MRI: comparative study between cartesian and radial techniques of k-space filling

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Purpose: Radial k-space filling allows an acquisition less prone to movement artefacts. The aim of this study is to assess overall image quality and compare cardiac measures derived two k-space sampling techniques (cartesian and radial) in the evaluation of ventricular function.
Methods and Materials: Ten healthy volunteers were enrolled in this study. Cardiac cine images ECG-gated were collected with a cine_SSFP sequence (standard short-axis orientation), with the two k-space sampling techniques. All images were qualitatively assessed on a four-point scale (4-excellent, 1-non-diagnostic). Statistical analysis was performed using Wilcoxon test. The

differences in the assessment of LV volumes and EF between both k-sampling techniques were tested using the Student's paired t-test.
Results: Radial technique presented images with fewer artefacts than the cartesian technique, with overall good delineation of the endocardium. In the qualitative analysis, radial technique had a median value of 3.00 while the cartesian had 2.00 (p=0.0315). For quantitative analysis EDV was 137.10±24.29 mL by the radial technique and 132.30±24.15 mL by the cartesian technique (p=0.182). The corresponding EF values were 69.63±4.09% and 68.56±5.17% (p=0.321).
Conclusion: Ventricular function assessment is feasible with the use of radial k-space sampling with better overall image quality. Radial k-sampling holds promise in the evaluation of patients with difficulties performing breath-hold techniques.

B-0682 10:39

Sonoelastography in differentiation of benign and malignant small sized ovarian tumours

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Purpose: The objective of this study was to evaluate the diagnostic possibilities of sonoelastography (SE) to differentiate benign from malignant small sized ovarian tumours.
Methods and Materials: 86 patients (aged 19-78 years) with ovarian tumours less than 3 sm were performed conventional TVU on HI VISION Preirus (Hitachi Medical Corporation). Modified Tsukuba sonoelastography classification was used for evaluation of the elasticity score of the tumour. Colour-Doppler and SE data were evaluated independently by two specialists. US results were compared with surgical and hystomorphological data, MRI, CT, PET-CT data and abdominal fluid aspiration results. Elasticity score according to the degree and correspondingly distribution of the strain were established (5 point color scale: 1-3 benign, 4-5 malignant). Strain ratio was calculated. Inter- and intraobserver variability was calculated.
Results: Based on the data of sonoelastography, 38 hysterectomies, 25 isolated resections of the tumours and 26 ovariectomies were performed. 48 benign and 41 malignant ovarian tumours were revealed by means of final histopathology. Sonoelastography increased the sensitivity (from 81% to 97%) and accuracy (from 82% to 94%) of US scanning in diagnostic of ovarian cancer. Pathomorphological results were compatible to sonoelastography data in most of the cases (k=0.84, correlation 92%). In 36% cases sonoelastography increased diagnostic confidence and helped to change the final diagnosis. The method of sonoelastography cannot itself determine the diagnosis, but in 32% cases it helped differentiating the nature of the tumour.
Conclusion: Real-time sonoelastography is a valuable tool that increases diagnostic confidence in differentiation small sized ovarian tumours.

B-0683 10:48

Magnetic resonance quantification of iron in basal ganglia using SWI technique

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Purpose: To verify the effectiveness of magnetic resonance (MR) measuring the iron concentration in basal ganglia, using susceptibility weighted imaging (SWI); to optimise intrinsic parameters of SWI sequence, in order to highlight the evidence of iron and compare those iron concentrations in basal ganglia among subjects, concerning age, gender and brain hemispheres.
Methods and Materials: 30 healthy subjects were selected and stratified into five aged groups, underwent a brain MR by a Magneton Avanto Siemens™ (1.5 T) system. Four SWI protocols were applied with different flip angle (FA) and slice thickness (TH); images were analysed by SPIN™ software, that allowed the ROIs drawing in phase images. The iron concentrations in mg/100 g of fresh tissue were measured in six bilateral basal-ganglia.
Results: In males, higher iron concentrations (21.429±0.374 mg/100 g) were found comparing to females (19.883±0.416 mg/100 g). The same trend was found in the left hemisphere (18.775±4.760 mg/100 g) and throughout differenced aged groups {[30-40[;[40-50[;[50-60[}; Substantia Nigra, Globus Pallidus, and Putamen presented higher iron concentrations.
Conclusion: The protocol choice is determinant to assess the iron concentration with high accurancy. In this study, the best protocol to highlight the evidence of iron concentration has one with smaller FA and higher TH. Iron concentration increase according to age increase, male's subjects and left hemisphere. The robust correlation between results and literature, lead to assume that iron concentration, measured by SWI, can be used as a biomarker and can be used by radiographers in the screening and follow-up of neurodegenerative diseases as Alzheimer, Parkinson and Huntington.

B-0684 10:57

Measurement of bone mass density: comparison of the absorptiometry (DEXA) and quantitative ultrasonometry methods

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Purpose: Osteoporosis, characterised by loss and hardiness of bone mass, leads to an increased risk of bone fractures. To use the QUS method, with reliability, in outpatients or some specific clinical settings such as elderly homes, continuing care centers, primary care in ambulatory environment, or in screening programs. This study aim to assess and to compare the values of bone mass density obtained through the QUS and DEXA methods and to verify if there is, or not, a constant variation in the obtained values from the same subject, allowing the establishment of a linear variation pattern.
Methods and Materials: The sample had 50-86 years old (average=64.16; SD=12,003). The inclusion criteria were: female, post-menopause, without bone fractures diagnosed. The bone mass density was evaluated on a set of 32 subjects, using the two methods consecutively. To data acquisition were used an Achilles InSight, System and a Norland both by GE®. Due the techniques' specificity the QUS was applied in the calcaneal region and the DEXA in the lumbar spine.
Results: Using Pearson's correlation tests, were obtained T-score values with r= 0.556 and Z-score value of r=0.461. The Student's t-test, shown a Z-score with p=0.005 and for the T-score p=0.466.
Conclusion: It was impossible to establish a trend or a linear variation value, but there was a positive variation between the T-score values in both methods. Each method may be applied with reliability but may not be replaced one by the other, being the QUS method informative and the DEXA diagnostic.

B-0685 11:06

3-point ultrasound for complete diagnosis of deep vein thrombosis of the lower extremities

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Purpose: To investigate the accuracy of 3-point ultrasound for diagnosis of DVT in patients referred to radiology from the emergency department.
Methods and Materials: Consecutive and prospective patients referred for imaging of the lower extremities to rule out primary DVT were asked to enrol in this study. Three points along the course of the veins were examined in the following areas: the inguinal area, the popliteal area and the point of maximum pain if and when identified by the patient's finger The reference tests were radiologic examinations and follow-up for six months. The radiologic examination was either complete ultrasound examination of the lower extremities or ascending venography performed immediately after 3-point ultrasound by a radiologist blinded to results of 3-point ultrasound.
Results: 110 patients have been recruited thus far with complete data and follow-up. No single case of false negative diagnosis has been detected.
Conclusion: With examination of three points along the course of lower extremity veins all cases of DVT were detected.

B-0686 11:15

Determining the value of non-traditional approaches to conventional radiographic imaging of neonates in the post-mortem setting

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Purpose: The number of autopsies carried out following sudden infant death continues to decline, and a stronger reliance on radiological imaging has been noted in these cases. Despite the growth in the use of cross-sectional imaging in forensics, conventional radiography continues to play a prominent role in post-mortem imaging of neonates. This study aims to determine the best combination of X-ray source, image receptor and kilovoltage peak for use in the neonatal post-mortem setting where cross-sectional imaging is unavailable.
Methods and Materials: Rib fractures were simulated on a foetal pig model and imaged using high and low kVp exposures on CR plates and mammography film across a Toshiba Kalare X-ray unit, a Siemens Mammomat 300 and a HP Faxitron 43807N cabinet system. A visual grading analysis (VGA) study was subsequently undertaken to determine which combination provided the best resolution of the simulated fractures.
Results: Use of mammography film in the cabinet X-ray system with a low kVp exposure provided the best demonstration of the simulated fracture of interest [mean image quality score (IQS) of 8.67]. This was closely followed by the combination of the mammographic unit and digital CR plate---again using a low kVp exposure (mean IQS of 7.33).
Conclusion: Where cross-sectional imaging is not available or not widely used in the post-mortem imaging of neonates, it is important to take into account the alternative approaches of attaining conventional radiographs. The role of the radiographer in determining the most appropriate approach to imaging such cases should not be undervalued.

B-0687 11:24

Is contrast agent necessary for MR angiography?

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Purpose: Despite the ongoing evolution of non-contrast-enhanced MRA techniques, contrast-enhanced MRA is still the standard for accurate diameter determination of the renal artery. But side effects and especially NSF are not negligible. Can CE-MRA sequences be replaced by NCE-MRA sequences, especially for patients with renal problems?
Methods and Materials: A self-made phantom was used to simulate the renal artery. The phantom consists of four small tubes made of glass, one without and three with stenosis (50, 67 and 75%). The data were acquired on an 1.5 T and 3 T scanner. The CE sequence was performed with a GE sequence with Gadovist® and the NCE sequence with a PCA sequence. There were also sequences taken with Dotarem®, but only on the 3 T machine. The images were evaluated by nine radiologists and nine radiographers.
Results: In the non-stenotic phantom, the results of CE and NCE sequences were similar. They were both capable of accurate measurement of the diameter. In the phantoms with stenosis, the PCA sequence overestimated the stenosis. When the stenosis increased, the overestimation was larger. CE sequences provided an accurate diameter determination. Only with a severe stenosis (75%), there was an underestimation. A 1.0 molar contrast agent yielded superior results to a 0.5 molar contrast agent.
Conclusion: A PCA sequence can replace a CE sequence when there is no stenosis in the renal artery. When there is a stenosis, a CE sequence can additionally be performed, especially when there is a severe stenosis. Preference should be given to a 1.0 molar contrast agent. More research is necessary for b-SSFP, FSE and ASL.

B-0688 11:33

Parallel MR imaging: technique and significance

M. Kiss, B. Lombay; *Miskolc/HU (kissmate20@gmail.com)*

Purpose: Parallel Acquisition Technique (PAT) is a special Magnetic Resonance (MR) imaging tool, which take advantage of the spatial information and reduce the acquisition time. Parallel imaging become widely available. There are different types of this technique and radiographers have a crucial rule to use this technique.
Methods and Materials: We applied a Siemens Magnetom Symphony 1.5 T, and a Siemens Magnetom Verio 3 T MR system. We examined 200 patients and use the PAT in different types of body part e.g. head, spine, abdomen, angiography, chest and cardiac. For the optimisation of the protocol and image quality we used different PAT (Grappa, mSense and Caipirinha). We analysed the image quality, the signal-to-noise ratio (SNR) and the acquisition time. Some characteristic examples will be presented.
Results: We found significant loss in SNR, and differences between the various parallel techniquesA few sequences are not good candidates for parallel imaging - when the SNR was too low. The Grappa technique was the best method in every type of sequences. The Cipiriniha was useable only the abdominal imaging. The mSense was much noisier than the Grappa and Caipirinha in every examinations. We couldn't find significant differences among the different type of sequences when we applied the PAT.
Conclusion: The parallel imaging have a wide range of clinical applications, it can be reduce the acquisition time and improved spatial resolution. The technique is attractive for cardiac-, abdomen and contrast enhancement MR applications. The main disadvantage to reduce the signal-to-noise ratio.

B-0689 11:42

Implementation of TraumaCad calibration ball in orthopaedic imaging in a radiology department: a multidisciplinary approach

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Purpose: TraumaCad® is digital templating software for pre-operative orthopaedic surgery planning. A correctly placed calibration ball (CB) in the X-ray is crucial for sizing of orthopaedic implants and visualisation of fracture reduction. Approximately, 10% of the images need a CB. Positioning of the CB is time consuming, challenging and may result in retakes. The metallic CB introduces artifacts possibly obscuring anatomic structures and pathology. The purpose of this study was to ensure the presence of a CB in all pre-operative X-rays as opposed to in all x-rays query fracture.
Methods and Materials: A three-step approach was adopted. 1. Comprehensive guidelines were developed, introduced and made available at all X-ray rooms. 2. Multidisciplinary education involving radiographers, radiologists and orthopaedic surgeons were arranged to gain an interdisciplinary understanding of the processes involved when placing the CB, reporting the X-ray and using TraumeCad. 3. Sessions, aimed specifically at radiographers, on how to identify fractures requiring surgery were held and repeated. Subsequently audits were performed.
Results: 270 consecutive patients were included, of which 24 needed surgery and 21 of those had a correctly placed CB. 246 patients did not need surgery, of those 225 were correctly identified as true negative and 21 had a CB in their X-ray. The sensitivity was 88% and the specificity 91%, with a positive predictive value of 50% and a negative predictive value of 98%.
Conclusion: The guidelines were successfully introduced and of the included patients, only three surgery-requiring fractures were missed potentially needing an additional CB image.

B-0690 11:51

Evaluation of the impact of specific training in the reduction of the radiography examination errors

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Purpose: A radiological protection system should be grounded on justification, optimisation and limitation, which requires the implementation of Quality Assurance Programs. Measure it is difficult with digital systems and as important changes in their analysis are evident we want to check the way a specific training programme affects the repetition rate of conventional digital radiographic studies.
Methods and Materials: Data from one month was measured and analysed in two digital conventional radiology rooms and an observational study, of prospective nature and fixed cohort, was carried out followed by a training programme which had an impact on them. Later, an analysis was carried out again in order to compare and evaluate the results. Thanks to the DICOM image headers, dosimetric data was analysed and once the relative unit of value was calculated, the approximate economic saving was estimated.
Results: The rejection rate have decreased 28% thanks to digital systems. It has been shown that the accountability of the rejection rate lies with the Radiographer. With training and commitment it is possible to obtain a 31% of reduction rates. Such a decrease has an impact both on the patient dosage and related costs.
Conclusion: The rejection rate is a key indicator of the quality of Radiology facilities and a clear tool which helps avoid unnecessary patient dose. The Radiographer must bring together and integrate knowledge to avoid repetitions especially due to erroneous practices. Its application and accountability should have straight results in dose reduction, contributing to facilitate high quality health care.

10:30 - 12:00 **Room F2**

Breast

SS 1302

MRI diffusion: update 2014

Moderators:
C. Dromain; Villejuif/FR
F. Pediconi; Rome/IT

B-0691 10:30

Can quantitative diffusion-weighted imaging (DWI) predict elevated MIB-1 proliferation index in invasive breast cancer?

C. Molinari, V. Bertani, A. Gualano, E. Di Gaetano, R. Girometti, V. Londero, C. Zuiani, M. Bazzocchi; *Udine/IT (molinari.cristina83@gmail.com)*

Purpose: To investigate whether quantitative Diffusion-Weighted Imaging (DWI) parameters predict elevated levels of MIB-1 proliferation index in patients with breast cancer.
Methods and Materials: We retrospectively enrolled 52 patients with biopsy- and surgically-proven invasive cancers (n=52), who underwent preoperative breast Magnetic Resonance imaging (MRI) on a 1.5 T magnet. MRI examination included a Single Shot Echoplanar DWI sequence with b values of 0 and 1000s/mm2. For each lesion, two experienced readers in consensus measured the apparent diffusion coefficient (ADC) (on the ADC maps) and lesion-to-background-ratio (LBGR) (on b=1000 s/mm2 images). Based on immunohistochemistry results, we then compared mean ADC and LBGR values between MIB-1-positive (> 14%) and MIB-1-negative (≤14%) patients using the unpaired T-test.
Results: Patients were assessed as MIB-1-positive and MIB-1-negative in 23/52 (44.2%) and 29/52 (55.8%), respectively. ADC values were significantly ($p < 0.05$) lower in MIB-1-positive patients (0.86x10-3 s/mm2; 95%IC 0.80 - 0.92) compared to MIB-1-negative ones (1.01x10-3 s/mm2; 95%IC 0.91-1.11). On the contrary, we showed no significant difference in LBGR between MIB-1-positive (6.73; 95%IC 4.15-9.32) and MIB-1-negative (9.14; 95%IC 4.45-12.82) women.
Conclusion: Lower ADC values at DWI are associated with elevated MIB-1 proliferation index in patients with invasive breast cancer.

B-0692 10:39

Evaluation of apparent diffusion coefficient to predict grade, micro-invasion and invasion in DCIS

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Purpose: To evaluate the role of apparent diffusion coefficient (ADC) in distinguishing DCIS grades and identifying micro-invasive/invasive disease.
Methods and Materials: 71 non-invasive/high-risk core-biopsy proven breast lesions were assessed preoperatively using diffusion weighted MRI. The ability of ADC values to distinguish DCIS grades and predict the presence of invasion was analysed.
Results: On 3 T, mean ADC value was 1.20 ×10−3 mm2/s ± 0.48 (SD) (range, 0.47 - 1.78 ×10−3 mm2/s) for non-high grade DCIS, 1.23 x 10-3 mm2/s ± 0.40 (SD) (range, 0.26 - 1.77 ×10−3 mm2/s) for high-grade DCIS, and 1.15 x 10-3 mm2/s ± 0.45 (SD) (range, 0.26 - 1.75 ×10−3 mm2/s) for invasive/microinvasive disease. On 1.5 T, mean ADC value was 1.04 x 10-3 mm2/s ± 0.41 (SD) (range, 0.15 - 1.85 ×10−3 mm2/s) for non-high grade DCIS, 1.01 x 10-3 mm2/s ± 0.37 (SD) (range, 0.06 - 1.76 ×10−3 mm2/s) for high-grade DCIS, and 1.11 x 10-3 mm2/s ± 0.30 (SD) (range, 0.64 - 1.76 ×10−3 mm2/s) for invasive/microinvasive disease. Based on logistic regression analysis, mean ADC value was not a significant predictor for invasiveness using 1.5 T [OR = 2.6 (95% CI (0.409, 17.12)), p=0.3] or 3 T [OR = 0.4 (95% CI (0.076, 2.399)), p=0.3]
Conclusion: Mean ADC acquired using a 1.5 T or 3 T MRI was unable to predict high-grade or invasive disease in biopsy-proven DCIS lesions. Further work is exploring voxel-based approaches that may better appreciate tumor heterogeneity and identify sub-regions of tumor with these higher risk features.

B-0693 10:48

Apparent diffusion coefficient measurements of breast tumours at routine breast magnetic resonance imaging: how reproducible are they?

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Purpose: Diffusion weighted imaging (DWI) is increasingly utilised for breast lesion characterisation and assessment of response to chemotherapy, but there is little data on reproducibility of measurements of the apparent diffusion coefficient (ADC). The purpose of this work was to analyse intra- and inter-observer variability of ADC measurements on a series of newly diagnosed breast malignancies.
Methods and Materials: IRB approval was waived for this retrospective study of anonymised data. 46 consecutive patients with biopsy-proven breast cancer were included. Two experts and one non-expert observer identified index lesions on DW images (b value 800 or 1,000 s/mm^2) and the corresponding ADC map. A region of interest was drawn around the lesion manually for whole-tumour ADC (ADC_{WT}); for the minimum ADC value (ADC_{min}), a 3 mm^2 ROI was moved over the area of restricted diffusion. Expert observers repeated the measurements after ≥ 1week. Intra and inter-observer variability was analysed with intraclass correlation coefficients (ICC) and Bland-Altman plots with calculation of coefficients of repeatability (CoR, all units in mm^2/s).
Results: For masses, reader agreement was high: ADC_{WT}, ICC 0.751, CoR 0.302; ADC_{min}, ICC 0.806, CoR 0.241. For nml, agreement was good for ADC_{WT} (ICC 0.611, CoR 0.499) but not ADC_{min} (ICC 0.289, CoR 0.578), unless the inexperienced reader was excluded (CoR 0.079). Intra-reader repeatability was excellent (ADC_{WT}: ICC> 0.972, CoR< 0.220; ADC_{min}: ICC> 0.976, CoR< 0.131).
Conclusion: ADC_{WT} measurements are generally highly reproducible for experts and non-experts. Reproducibility is higher for masses than nml, and for ADC_{WT} rather than ADC_{min}, where tumour heterogeneity and artefact probably confound inexperienced readers.

B-0694 10:57

Quantitative analysis of apparent diffusion coefficient maps for breast cancer diagnosis in 3 T diffusion-weighted MRI

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Purpose: To investigate the feasibility of histogram analysis of ADC maps for differentiating malignant from benign breast lesions in 3.0 T diffusion-weighted MRI (DW-MRI).
Methods and Materials: Dataset analysed consists of 89 histologically verified breast lesions (51 malignant, 38 benign) of patients who underwent DW-MRI at 3.0 T (b-values 0, 900 s/mm^2). ADC maps were generated for a slice representative of lesion largest diameter. An expert radiologist manually delineated lesion contour on ADC map, defining the lesion region of interest to be subjected to histogram analysis considering: mean, standard deviation, skewness, kurtosis, entropy, maximum, minimum and range of ADC values. The discriminating ability of individual histogram features, as well as of feature combinations, was investigated employing a least squares minimum distance classifier. Classification performance was evaluated by means of the area under receiver operating characteristic curve (Az).
Results: Malignant lesions demonstrated statistically significant lower median value of ADC feature mean (0.94 x10-3 mm^2/s) and maximum (1.43x10-3 mm^2/s), as compared to benign lesions (mean: 1.49x10-3 mm^2/s and maximum: 1.94x10-3 mm^2/s). Malignant lesions demonstrated increased entropy (5.82) reflecting increased ADC heterogeneity, as compared to benign ones (5.62). Among individual features, best classification was achieved by ADC feature mean (Az=0.87±0.04). The feature subset comprising of ADC mean, entropy and minimum demonstrated the highest classification performance (0.91±0.03).
Conclusion: Histogram analysis of ADC maps allows for quantification of specific lesion ADC heterogeneity properties, improving the potential of DW-MRI in differentiating malignant from benign breast lesions.

B-0695 11:06

BI-RADS 4 lesions only visible on contrast-enhanced MRI: can apparent diffusion coefficient measurements differentiate benign from malignant?

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Purpose: Due to its high sensitivity, contrast-enhanced breast MRI detects suspicious lesions otherwise not visible. Here, MRI-guided biopsy is applied. Unnecessary biopsies in benign lesions cause costs and patient inconvenience and should thus be avoided. This study investigates the use of apparent diffusion coefficient (ADC) in lesions only visible on MRI.
Methods and Materials: A retrospective review of our single-center prospectively populated database revealed 101 patients (mean age 49.5, SD 13.9, median 48, IQR 17 years) who underwent diffusion-weighted imaging at 1.5 T. The patients showed 104 lesions visible on MRI only classified as BI-RADS 4 based on BI-RADS criteria and were scheduled for MRI-guided biopsy. ADC values were measured by an experienced radiologist blinded to histopathologic results. Diagnostic accuracy was investigated using ROC analysis.
Results: Histopathology revealed 20 malignant and 84 benign lesions. Lesions were classified as mass in 61 (15 malignant, 24.6%) and non-mass in 43 (5 malignant, 11.6%). At an ADC cut-off level of ≤ 1.258*10^{-3} mm^2/s, ROC analysis showed a sensitivity and specificity for ADC measurements of 80% and 79.8%, respectively. In mass lesions, sensitivity and specificity were 93.3% and 82.6%. In non-mass lesions, lower sensitivity (80%) and specificity (65.8%) were observed.
Conclusion: ADC measurements can help to differentiate breast lesions only visible on MRI and classified as BI-RADS 4 by BI-RADS criteria. Higher sensitivity and specificity are observed in mass lesions as compared to non-mass lesions was observed.

B-0696 11:15

Improving the accuracy of breast MRI: could diffusion-weighted imaging (DWI) overcome background parenchymal enhancement (BPE)?

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Purpose: BPE can limit the accuracy of breast-MRI similarly to what occurs in mammographically dense breast, requiring a short-term, expensive MRI-follow-up. We evaluated if the adjunct of DWI could help in this difficult setting.
Methods and Materials: Out of 1757 MRI examinations performed from 2008 to 2013, 338 (19%) were reported of limited diagnostic value due to BPE; 84 including DWI and a minimum 1-year follow-up were considered. Four classes were defined according to their BPE patterns: 40% (34/84) of women had minimal BPE, 38% (32/84) mild BPE, 14% (12/84) moderate and 7% (6/84) marked. MRI alone and MRI+DWI were compared regarding diagnostic performance, BI-RADS, biopsy rate, histopathology/follow-up. Agreement with histopathology was assessed by the estimate of the Cohen's K statistic.
Results: A higher number of BI-RADS 1-2 was found in patients with minimal BPE than in those with mild to marked (p=0.001). Out of 31 suspicious enhancements, 47% were confirmed as malignant (7 IDC, 3 ILC, 3 tubular and 1 papillary carcinoma, 2 DCIS, 2 sarcoma). There was no significant difference in biopsy rate among various BPE patterns. The sensitivity, specificity, positive and negative predictive values were, respectively, 89%, 87%, 53% and 98% for MRI alone, 93%, 84%, 70% and 97% for MRI+DWI. Agreement with histopathology was improved by DWI (k=0.71 vs. k=0.59).
Conclusion: Compared to conventional breast-MRI, DWI significantly improves the positive predictive value in case of BPE. However, since DWI does not increase the negative predictive value, all BPEs with negative DWI should undergo a short-term follow-up.

B-0697 11:24

Can diffusion-weighted magnetic resonance imaging differentiate between metastatic and non-metastatic axillary lymph nodes in patients with breast cancer?

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Purpose: To assess the accuracy of Diffusion-weighted Magnetic Resonance Imaging (DWI) in differentiating between metastatic and normal axillary lymph nodes in patients with breast cancer.
Methods and Materials: 250 patients with histologically proven breast cancer underwent breast MRI (1.5 T; 4-channel coil) within two weeks prior to axillary dissection. The axilla ipsilateral to the tumor was included into the field of view; if a lymph node was detected with morphological features (short axis = 7 mm or more) deeming malignancy likely, DWI (b values: 0 and 800 mm/sec2) was performed and a lymph nodal Apparent Diffusion Coefficient (ADC) was obtained through the average of three different measurements. Patients were included if histology after axillary dissection demonstrated, in the lymph node evaluated with DWI, either a metastasis larger than 5 mm or the absence of metastases. 43 patients (age range: 38-79 years) meeting the above mentioned criteria were included in this study. The Student's t-test was used.
Results: At histology 19 patients had one lymph node with a metastasis larger than 5 mm and 24 had not. The ADC values of the metastatic lymph nodes (mean: 0.878 mm2/sec; range: 0.30-1.20) were significantly lower ($p < 0.001$) than those of the metastasis-free lymph nodes (mean: 1.494; range: 0.60-2.50). With a cutoff value of 1.09 mm2/sec (two false positive; one false negative result) DWI proved 94.7% sensitive, 91.7% specific and 93.0% accurate in the diagnosis of lymph node metastasis.
Conclusion: DWI is able in differentiating between metastatic and metastasis-free axillary lymph nodes in breast cancer.

B-0698 11:33

Diffusion-weighted imaging of breast lesions: a systematic review and meta-analysis

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Purpose: To evaluate the effect of the choice of b-values and prior use of contrast medium on ADCs of breast lesions derived from DWI, and on the discrimination between benign and malignant lesions.
Methods and Materials: A literature search was performed of relevant DWI studies. Meta-analysis focussed on ADC-values rather than true diffusion, not available in the fast majority of studies acquired with just a few b-values. The accuracy of DWI to characterise lesions by using b-value ≤600s/mm^2 and b-value > 600s/mm^2 was presented as pooled sensitivity and specificity. The ADC was calculated for both groups. This choice of cut-off was motivated by earlier findings in a breast DWI study of healthy volunteers, demonstrating that at b-values smaller than 600s/mm^2 the DW signal is monoexponential. Also, lesions were pooled as pre- or post-contrast DWI.
Results: Of 317 articles, 26 met the inclusion criteria. Mean ADC was significantly higher ($p < 0.001$) for the group of b-values ≤600s/mm^2 compared to > 600s/mm^2. The sensitivity (91% and 89%, respectively) and specificity (75% and 84%) were similar ($p > 0.05$) in both groups. Contrast media had no significant effects on the ADCs ($p > 0.08$). The contrast between benign and malignant lesions was optimal (58.4%) for the combination of b=0 and 1000s/mm^2.
Conclusion: The wide variety of b-value combinations applied in different studies significantly affects the ADC of breast lesions and therefore confounds quantitative DWI. If only a couple of b-values are used, those of b=0 and 1000s/mm^2 are recommended for the best improvement of contrast between benign and malignant lesions.

B-0699 11:42

Quantitative diffusion-weighted imaging at 3 T for the detection of breast cancer: influence of ROI-selection on the diagnostic performance

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Purpose: Diffusion-weighted imaging (DWI), using apparent diffusion coefficient (ADC), is a powerful tool for the diagnosis of breast cancer. However, no consensus on which is the best way to measure ADC exists. Thus, the aim of this study was to compare different approaches on region of interest (ROI) selection and their influence on diagnostic performance.
Methods and Materials: 3 T MRI-scans of 102 patients with breast lesions (BI-RADS 3-5) were evaluated by a blinded reader. T2-w, contrast-enhanced T1-w and DWI sequences were used for lesion identification. Manually drawn ROIs were placed on the ADC maps: a two-dimensional (2D) ROI inside the lesion part with the lowest ADC values and a three-dimensional (3D) ROI covering the whole lesion. Minimum, maximum and mean ADC was measured. All lesions were histopathologically verified. Means were compared between benign and malignant lesions and between the different measurement approaches. ROC-curves were drawn to compare diagnostic performance.
Results: Mean ADC was significantly different between benign (n=20) and malignant (n=82) lesions for both 3D and 2D ROIs in all measurements ($p < .001$). ROC curves showed comparable results (AUC between.97 and.993) for all approaches except maximum ADC of the whole lesion (AUC.794). Maximum ADC in the region of the lowest ADC was best for differentiation of benign and malignant lesions.
Conclusion: All measurement approaches except maximum ADC of the whole lesion performed excellently and are feasible for the differentiation of benign and malignant breast lesions.
Author Disclosures:
T.H. Helbich: Consultant; Siemens AG, Hologic Inc. Grant Recipient; Siemens AG.

B-0700 11:51

Quantitative diffusion-weighted imaging (DWI) of additional lesions at pre-operative breast MRI: a practical tool to prevent overtreatment?

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Purpose: To assess the impact of DWI on the surgical management of additional lesions depicted at pre-operative MRI.
Methods and Materials: Out of 150 patients undergoing breast MRI for locoregional staging between 2008 and 2013, 50 directly underwent surgery. MRI examinations were classified based upon additional lesions features and location: no impact if no additional lesion was identified or if the additional lesion (s) didn't change surgery; good impact if additional malignant lesions were correctly identified (extended surgery); bad impact when an additional suspicious lesion was not confirmed at final histopatology (incorrect extended surgery). Additional lesions were classified according to their morpho-kinetic features and DWI signal (BI-RADS).
Results: Of the 46 additional findings seen on MRI, 35 required a wider surgery. In 29% (10/35) of these, malignancy was not confirmed at final histopathology. The Apparent Diffusion Coefficient (ADC) measured with DWI would have correctly diagnosed all the 25 additional malignancies, modifying the multifocal/multicentric status. Dynamic-MRI alone had no impact on 31 patients (64%), good impact on 11 patients (22%) and bad impact on 8 patients (14%). The addition of ADC to dynamic-MRI would have lead to no impact on 35 patients (70%), good impact on 14 patients (28%) and bad impact on 1 patient (2%).
Conclusion: Quantitative DWI improves the performance of pre-operative Breast MRI in the characterisation of additional lesions, allowing a more confident definition of multicentric and multifocal disease. This feature can be helpful in reducing the number of pre-surgical biopsies and unnecessary extended surgery induced by Breast-MRI.

10:30 - 12:00 **Room G/H**

Genitourinary

SS 1307

Renal tumours: diagnosis and intervention

Moderators:
T.M. Cunha; Lisbon/PT
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B-0701 10:30

Multiparametric magnetic resonance imaging to differentiate common subtypes of renal tumours

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Purpose: To retrospectively evaluate the ability of magnetic resonance (MR) imaging to differentiate common types of renal tumours using parameters derived from routinely performed sequences.
Methods and Materials: MR images from 100 pathologically proven solid renal tumours without macroscopic fat (57 clear-cell, 16 papillary, 7 chromophobe renal cell carcinomas (RCCs), 16 oncocytomas and 4 minimal fat angiomyolipomas (AMLs)) treated at a single institution between 2009 and 2012 were evaluated. Two radiologists blinded to pathology results reviewed independently double-echo chemical shift, T1- and T2-weighted images, and ADC maps. Signal intensity index (SII), tumour-to-spleen SI ratio (TSR), ADC ratio, wash-in (WiI) and wash-out indices (WoI) between different phases (arterial, parenchymal or late) were calculated. Results were analysed with Wilcoxon sum rank, Fisher's exact tests and receiver operating characteristics, and diagnostic accuracy estimated. A Bonferroni correction was applied to correct for multiple testing.
Results: There were significant differences between papillary RCCs and other renal tumours for arterial WiI ($P < 0.001$, area under the curve (AUC)=0.92), initial WoI (P=0.006, AUC=0.72) and ADC ratio ($P < 0.001$, AUC=0.85); between chromophobe RCCs and oncocytomas for TSR (P=0.02, AUC=0.8), parenchymal WiI (P=0.03, AUC=0.74), late WiI (P=0.02, AUC=0.77), initial WoI (P=0.03, AUC=0.8) and late WoI (P=0.04, AUC=0.79); and between clear-cell RCCs and oncocytomas for SII (P=0.01, AUC=0.71) and parenchymal WiI (P=0.01, AUC=0.69). Multiparametric analysis distinguished papillary RCCs from other renal tumours (sensitivity: 37.5%, specificity: 100%) and oncocytomas from chromophobe and clear-cell RCCs (sensitivity, specificity: 25%, 100% and 18.7%, 94.2%, respectively).
Conclusion: Multiparametric MR imaging seems useful before deciding the most appropriate therapeutic management.

B-0702 10:39

Contribution of ADC value to histopathological differentiation of renal tumors

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Purpose: To evaluate ability of the apparent diffusion coefficient (ADC) value in differentiation of histological types of renal tumors.
Methods and Materials: MRI examination including DWI with b coefficients 0, 400, 1000 was performed in 82 patients with renal tumor before surgery. Mean ADC values in tumor lesion were correlated with histopathological finding after surgery. Histopathological typing proved 61 cases of clear cell carcinoma (ccRCC), 8 papillary RCCs, 2 chromophobe RCCs, 5 oncocytomas, 3 angiomyolipomas, 2 urethelial carcinomas and 1 papillary adenoma. Results were statistically correlated by t-test.
Results: Mean ADC value in different renal tumors was: ccRCC 1.51 x 10^{-3} mm^2/s, papillary RCC 0.855 x 10^{-3} mm^2/s, chromophobe RCC 0.82 x 10^{-3} mm^2/s, oncocytoma 1,351 x 10^{-3} mm^2/s, angiomyolipoma 1.72 x 10^{-3} mm^2/s, urothelial carcinoma 1.1 x 10^{-3} mm^2/s, papillary adenoma 1,445 x 10^{-3} mm^2/s. Correlation between different histopathological types of renal tumors and mean ADC value was found ($p < 0.05$). Correlation between histological grading and mean ADC value in ccRCC was statistically significant ($p < 0.03$).
Conclusion: Mean ADC value is helpful in histopathological differentiation of renal tumors.

B-0703 10:48

Small clear cell renal carcinoma: correlation between CT findings and histologic grade

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Purpose: To evaluate the correlation between CT findings and histologic grade (Fuhrman grade) of small clear cell renal cell carcinoma (CCRCC), which is significant prognostic factor.
Methods and Materials: We retrospectively reviewed 88 pathologically proven small (≤4 cm, pT1a), CCRCCs in 87 patients. Two radiologists independently analysed tumour shape, margin, encapsulation, enhancement pattern and relative enhancement to renal cortex on CT scan. Enhancement patterns were defined according to the percentage of diffuse enhancement (pattern 1, homogeneous ≥90%; pattern 2, relative homogeneous 75-90%; pattern 3, heterogeneous < 75%). Histologic grade was divided into two groups: low (Fuhrman grade 1 or 2) and high (3 or 4).
Results: Sixty low-grade (68.2%) and twenty-eight high-grade (31.8%) small CCRCCs were assessed. We found a statistically significant correlation between enhancement pattern and the Furhman grade with good interobserver agreement. The lower grade RCCs tend to be more homogeneous enhancement ($p < 0.001$ and p=0.003, reader 1 and reader 2, κ=0.688). Hyperattenuating tumour than adjacent normal renal cortex was exclusively founded in the low-grade group (p=0.024 for both readers, κ=0.635). The prevalence of ovoid shape, indistinct margin and absence of encapsulation in low-grade RCCs were significantly greater than in high-grade group for reader 1, but no significant difference was found for reader 2 (p=0.003, p=0.028, $p < 0.001$, respectively for reader 1; p=0.895, p=0.680, p=0.674, respectively, for reader 2).
Conclusion: Homogeneous tumoural enhancement and hyperattenuating tumour at contrast-enhanced CT were related to low-Fuhrman grade of small CCRCCs. These data may have implications for active surveillance of small CCRCCs.

B-0704 10:57

The use of contrast-enhanced ultrasonography (CEUS) in classification of renal cystic lesions

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Purpose: To evaluate the classification of cystic renal lesions with CEUS and to compare the results with CT.
Methods and Materials: The set consists of 112 lesion in 94 patients who had CT and CEUS with renal lesion that was cystic on at least one of the methods. Lesions were evaluated by Bosniak classification and either histologically verified or followed-up for at least 2 years. We assessed correlation between methods, sensitivity and specificity for malignancy detection from the viewpoint of Bosniak classification, sensitivity for detection of individual features used in Bosniak classification and odds ratios of malignancy for this features. Data were processed by ROC analysis. Statistical significance was assessed by Fisher's exact test.
Results: Overall agreement between methods was 61%, with division to non-surgical (category I, II, IIF) and surgical (III, IV, solid) groups agreement was 90%. With this division sensitivity, specificity, PPV and NPV was 92.3%, 90.9%, 57.1%, 98.9% for CEUS and 69.2%, 94.9%, 64.3%, 95.9% for CT. CEUS was more sensitive than CT in detecting septa (53% vs. 25% of lesions, $p < 0.001$) and in detecting enhancement of septa (22% vs. 10% of lesions, $p < 0.001$). Solid component enhancement was not significantly different, but on CEUS this was more predictive factor for malignancy detection (increased likelihood of malignancy 384 times on CEUS, 78 times on CT, $p < 0.001$).
Conclusion: Results of CEUS correlate with CT. Sensitivity of CEUS for the detection of malignancy was higher than that of CT, specificity was slightly lower.

B-0705 11:06

The accuracy and interobserver variability of multidetector computer tomography (MDCT) for T staging of renal cell carcinoma

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Purpose: To determine the accuracy and interobserver variability of multidetector computer tomography (MDCT) for T staging of patients with renal cell carcinoma.
Methods and Materials: Two young readers, with three and six years of experience in genitourinary imaging, independently and in consensus reviewed the imaging and histology data of 113 patients (84 males, mean age 57.4±12 years) with RCC (91-clear-cell, 15-chromophobe, 4-papillary, 2-collector duct, 1-translocation). Patients underwent multiphase contrast enhanced 64-MDCT and partial or radical nephrectomy. Pathological analysis revealed 54 (47.8%) T1 lesions (25-T1a, 29-T1b), 10 (8.8%) T2 lesions (6-2a, 4-2b), 45 (39.9%) T3 lesions (34-3a, 11-T3b) and 4 (3.5%) T4 lesions. The accuracy of MDCT in T staging of RCC was assessed using receiver operating curve (ROC) analysis. Interobserver variability was assessed using inter-rater agreement statistics (Kappa).
Results: In consensus, MDCT performed best in predicting RCC stage T1 (AUROC=0.87, Se=92.6%, Sp=81.4%) and stage T4 (AUROC=0.87, Se=75%, Sp=100%). The AUROC for stage T2 was 0.71 (Se=50%, Sp=93.2%) and for stage T3 was 0.78 (Se=66.7%, Sp=89.7%). Independently, the more experienced reader performed better in T staging of RCC, in good agreement

with the histology results (kappa=0.78), correctly classifying 50 patients with T1 (92%), 5 patients with T2 (50%), 30 patients with T3 (66%) and 3 patients with T4 (75%). The interobserver agreement was fairly good (kappa=0.61).
Conclusion: MDCT performs best in predicting early (stage T1) and advanced RCC (stage T4), with fairly good interobserver variability.

B-0706 11:15

Novel anatomic kidney segmentation in nephron sparing surgery: a comprehensive CT-scan based reporting
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Purpose: Introduce a novel a segmental anatomy of the kidney with a standardised radiological reporting method to describe renal masses (< 7 cm) location and pathological features.
Methods and Materials: 63 patients underwent multiphase MDCT scan with 1 mm acquisitions. We divided the kidney into 3 zones and 12 segments. 2 radiologists blindly read all cases according to a standardised report method: tumour size, location in kidney's segments, exophityc growth, collecting system's relationship and tumour's feeding arteries (FA). Intra and inter-observer reliability was assessed with k-statistic test.
Results: 63 tumours were diagnosed. 10 (15.8%) were mono-segmental, 23 (36.5%) involved 2 segments, 18 (28.5%) involved 3 segments, and 12 tumours (19%) involved 4 segments. Mean exophytic percentage of the lesions was 24.9%: 8.6 % of the tumours were > 2/3 exophytic, in 40 % of the tumours the exophytic growth pattern was comprised between 1/3 and 2/3, 36.1% were < 1/3 exophytic and 15.2 % were completely endophytic. Dislocation and infiltration of the collecting system was observed in 21 (28.5%) and 16 (25.4%) tumours, respectively. In the remaining 26 tumours, mean distance from the collecting system was 7.7 mm. In 39 tumours, one FA was detected; in 15 tumours, two FAs were detected and in 9 tumours 3 or 4 FAs were detected. Intra and inter-observer reliability resulted as k=0.95 and 0.91, respectively. Mean reporting time was 16±4 mins.
Conclusion: Kidney segmentation and standardised radiological report are an exhaustive manner to describe small renal masses location and provide information for clinical practice.

B-0707 11:24

Early antiangiogenic effects of multikinase inhibitors in patients with metastatic renal cell cancer using dynamic contrast enhanced CT: initial results of a pilot study
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Purpose: To correlate early changes of tumor perfusion assessed by DCE-CT in mRCC patients under MKI with available preliminary data of clinical response.
Methods and Materials: 40 patients (29 males, 11 females, 68±7 years) with mRCC underwent perfusion CT imaging of representative metastatic lesions on a dual-source CT scanner (10 cm z-axis coverage, acquisition time 43 sec, 100 kVp (abdomen), 80 kVp (chest), 100 mAs). Two subsequent DCE-scans were performed before and 7 days after start of treatment with Sunitib (n=30) or Pazopanib (n=10). Blood flow (BF), blood volume (BV) and permeability-surface area product (PS) were calculated for the entire tumor volume. Results were correlated to RECIST-based response and progression-free interval (PFI).
Results: Comparing baseline and follow-up scan, perfusion CT showed a profound reduction of mean BF, BV and PS 7 days after therapy initiation (range -44% to -31%; all p-values< 0.001). Responders (n=15) - defined by their best overall response according to RECIST - showed a significantly greater reduction of mean BF and BV-values on day 7 than Non-Responders (= patients with stable/progressive disease, n=25): -53%±26% vs. -32%±28% for BF and -51%±20% vs. -33%±25% for BV, all p-values< 0.05. Mean BF-reduction in patients with a PFI > 7 months (n=24) was more pronounced than in patients with a PFI < 7 months (-57%±29% vs. -32%±23%; p=0.029). PS-perfusion indices were not found predictive for therapy response.
Conclusion: Early changes in DCE-parameters of tumor perfusion in patients with mRCC under MKI might yield the potential to predict biologic response to antiangiogenic drugs.
Author Disclosures:
A. Sterzik: Grant Recipient; Bayer Healthcare. **M. Staehler:** Consultant; Novartis, Pfizer. Speaker; Novartis, Pfizer. **A. Graser:** Consultant; Siemens Healthcare, Bayer Healthcare. Speaker; Bayer Healthcare, Siemens Healthcare.

B-0708 11:33

Beyond RECIST criteria: the role of MR perfusion in evaluating response to anti-angiogenic therapy in patients with metastatic renal cancer
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Purpose: To determine the role of MRI perfusion technique for evaluating response to anti-angiogenic therapy in patients with metastatic renal cell carcinoma (RCC) using as criteria the dimensional changes and the vascularisation degree.
Methods and Materials: 46 patients (108 lesions) with primitive and/or metastatic RCC were evaluated with MRI before and during anti-angiogenic therapy (at 0, 4, 8 weeks); we assessed the lesion changes of dimension according to RECIST guidelines and vascularisation degree through perfusion volume (VP) evaluation; to obtain this parameter, we used a T1-weighted GRE sequence acquired after intravenous administration of contrast medium and an editing software (Functool 7.4).
Results: After 4 weeks, we observed a response to therapy (complete or partial: CR/PR) in 67.7% of lesions considering the size criteria and 77.6% according to VP; stable disease (SD) in 6.5% considering RECIST and 3% according to VP; progression of disease in 25.8% according to RECIST and in 19.4% considering VP. After 8 weeks, we reached a CR/PR in 74% of the lesions taking into account RECIST and in 80% considering VP, SD in 6% according to RECIST and in 0% taking into account VP, PD in 20% of the lesion considering both methods of analysis (RECIST and VP).
Conclusion: Functional MRI is a valid method for evaluating neoangiogenesis in primary and/or metastatic RCC; considering VP rather than dimensional changes allows to assess early anti-angiogenic therapy effectiveness to determine a proper use.

B-0709 11:42

Radiofrequency ablation of sporadic cystic renal masses: mid-term outcomes
H. Kim, M. Cha, B. Park, J. Park, S. Park, C. Kim; *Seoul/KR (haejin0324.kim@samsung.com)*

Purpose: To retrospectively investigate the mid-term outcomes of radiofrequency ablation (RFA) for sporadic Bosniak III or IV masses.
Methods and Materials: Between May 2003 and May 2013, 27 patients (mean, 55 years; range, 22 - 77 years) with 27 sporadic cystic renal masses (mean, 2.8 ± 0.2 cm; range, 1.1 - 4.8 cm) underwent percutaneous RFA and follow-up CT or MRI was performed for 6 months or longer (mean, 23.4 ± 3.5 months; range, 6 - 65 months). Renal masses consisted of 18 Bosniak III and 9 Bosniak IV lesions. The mean ablation duration, number of session, technical success rate, primary and second effectiveness rates, cancer-specific and overall survival rates, complications, and estimated glomerular filtration rate (eGFR) were analysed. The Kaplan-Meier survival curve and Wilcoxon Signed-rank test were used for the statistical analysis.
Results: The mean ablation duration and number of session were 20.5 ± 18.7 min (range, 5 - 78 min) and 1.1 ± 0.3 (range, 1 - 2), respectively. The technical success rate was 100% (27/27). The primary and secondary effectiveness rates were 88.9% (24/27) and 100% (3/3), respectively. The 2-year cancer-specific and overall survival rates were 100% and 95.5%, respectively. The major and minor complication rates were 3.7% (1/27) and 25.9% (7/27), respectively. The median eGFR had decreased slightly 1 - 6 months after the RFA (pre-RFA, 80.5 mL/min/1.73 m^2; post-RFA, 74.8 mL/min/1.73 m^2; $p < 0.001$).
Conclusion: RFA has potential to effectively treat sporadic Bosniak III or IV masses in poor surgical candidates.

B-0710 11:51

Modified renal score: quantitative criteria predicting the complexity of radiofrequency ablation of renal tumours
R. Betari, A. Mejean, C. Elie, M.-O. Timsit, S. Richard, V. Delmas, O. Helenon, J.-M. Correas; *Paris/FR*

Purpose: To develop and test a predictive score for complications (including therapeutic failure) of radiofrequency ablation (RFA) of renal tumours.
Methods and Materials: 442 consecutive RFA procedures were retrospectively evaluated between 2005 and 2012. We collected and analysed each of the following data on imaging regarding the tumour to determine their clinical relevance separately and as a score: depth, diameter, size of the endophytic portion, distance between the tumour and the closest critical anatomical structure, distance between the tumour and a perpendicular line to the renal sinus, distance between the tumour and the digestive tract or the diaphragm, tumour enhancement. We defined two groups using the Clavien-Dindo scoring system (CD) and the therapeutic outcome of the procedure (CD< 2 and success vs. CD≥2 or failure). Data were analysed using the Student t test and Wilcoxon test.

Results: Five criteria were useful to predict the complexity of a procedure. Depth (p=6.55.10e-5), diameter (p=2.79.10e-8), endophytic extension (p=6.01.10e-9), distance to the closest critical anatomical structure (p=1.21.10e-9), distance to the digestive tract (p=0.029). Thresholds were found for the first three criteria (respectively 85, 26, 20 mm). There was no statistically significant difference between the two groups for the other criteria.
Conclusion: A new predictive score using relevant criteria can be proposed to assess a renal tumour before a RFA. Complications or therapeutic failure is less likely to happen after a procedure if the tumour is less than 26 mm, superficial, mainly exophytic, distant to the digestive tract, located far from a critical organ.

10:30 - 12:00 **Room I/K**

Neuro

SS 1311

Endovascular treatment

Moderators:
A. Dörfler; Erlangen/DE
I.Q. Grunwald; Oxford/UK

B-0711 10:30

Thrombus-length pedicts outcome in patients with cerebral artery occlusion treated with intravenous fibrinolysis

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Purpose: The length of a cerebral artery occlusion has been suggested to affect the efficacy of intravenous fibrinolysis in facilitating reperfusion. We investigated the association between thrombus-length and short- and long-term outcome.
Methods and Materials: We included patients admitted within 4.5 hours after onset of stroke and a computed tomography angiography (CTA) demonstrated middle cerebral artery occlusion. All patients had intravenous tissue plasminogen activator as only reperfusion therapy. Thrombus-length was measured on CTA. Short-term outcome was measured as difference between National Institute of Health Stroke Scale on admission and day-2 (ΔNIHSS). Long-term outcome was measured as 90-days modified Rankin Scale (mRS).
Results: We included 70 patients. Mean (SD) thrombus-length was 22.0 mm (10.0 mm). The median (IQR) NIHSS on admission was 14 (9-18) and 9 (3.5-16) on day 2; 90-days median (IQR) mRS was 3 (1-5). There was a good correlation between admission NIHSS and thrombus-length (r_s = 0.312; p = 0.009) as well as 90-day mRS and thrombus-length (r_s = 0.262; p = 0.034). No correlation was observed between ΔNIHSS and thrombus-length (r_s= -0.139; p = 0.255). Increasing thrombus-length was a univariate predictor of good (mRS 0-3) and poor (mRS 5-6) outcome (OR 0.94 CI: 0.90-0.99 and OR 1.17 CI: 1.01-1.14 per mm increase, respectively). When adjusting for NIHSS and age, the effect of thrombus-length on good outcome was removed however the effect on poor outcome remained (OR 1.09 CI: 1.01-1.16 pr. mm)
Conclusion: Thrombus-length covariates with stroke severity and predicts poor outcome. Thrombus-length is not associated with early remission after fibrinolysis.

B-0712 10:39

MR angiographic and clinical long-term follow-up after intracranial mechanical thrombectomy using solitaire FR device

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Purpose: Little is known about consequences of arterial wall damages possibly due to mechanical endovascular thrombectomy (MET). Our aim was to perform angiographic and clinical long-term follow-up (FU) of patients treated with MET using Solitaire FR.
Methods and Materials: Forty-five stroke patients treated during August 2010 to February 2012 were prospectively evaluated. Angiographic imaging was performed on a 3 T MRI and included intracranial arteries TOF-MR angiography (MRA) and supra-aortic arteries gadolinium-enhanced MRA. Images were assessed to detect arterial anomalies (stenosis, occlusions, and dilatation) in comparison post-MET final run.Clinical evaluation was performed with the modified Rankin Scale score (mRS), compared with 3-month mRS, and the quality of life SF-36 scale.
Results: Thirty-four patients were assessed at the mean term of 449 days (median 451; range 196-677), 4 were lost to follow-up and 7 died. MRA showed 5 delayed intracranial arterial anomalies in 4 patients, 4 stenosis and 1 dilatation, 4 pre-existing intracranial arterial stenosis and 1 pre-existing cervical arterial stenosis. These all patients remained asymptomatic during FU period. A significant clinical improvement was observed between 3 months and long-term FU (p <0.0001), with a good outcome (mRS ≤ 2) achieved from 54.5% to 61% of patients. Health-related quality of life was better than that of unselected patients with stroke.
Conclusion: Long-term FU of patients treated with Solitaire shows asymptomatic arterial anomalies and further clinical improvement, suggesting that MET entails a systematic long FU including MRA.

B-0713 10:48

Safety and efficacy of a new device for the treatment of wide neck bifurcation aneurysms: preliminary experience

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Purpose: Wide neck bifurcation aneurysms (WNBA) are considered to belong to the subgroup of aneurysms with increased difficulty and risks. Balloon- and stent-remodelling are known techniques for their treatment. pCONus is a self-expanding, completely retrievable, electrolytically detachable device with a proximal shaft, 4 distal petals and a nylon cross in the distal end of the shaft. The device is made to bridge the orifice of WNBA in order to allow better control of the coil occlusion. It combines elements of "waffle cone" stent deployment and the no longer available TriSpan Device. Our purpose was to evaluate the safety and efficacy of this device for the treatment of WNBA.
Methods and Materials: 25 consecutive patients underwent endovascular treatment of WNBA using pCONus between February 2012 and May 2013. Target vessels included the anterior circulation in 19 (76%) and the posterior circulation in 6 (24%). 8 patients were treated in the setting of acute subarachnoid haemorrhage (32%).
Results: Neither technical failure nor rupture was encountered. Acute thrombi formation was observed in one patient (4%), which resolved after administration a body weight adapted bolus dose of eptifibatide (Integrilin). After the initial procedure, total occlusion was achieved in 7 (28%) patients and a neck remnant was evident in 9 (36%). Follow-up angiography was available in 21 patients and demonstrated complete occlusion in 13 (61.9%). Evident coil compaction requiring re-treatment was observed in three patients. pCONus also assisted re-coiling.
Conclusion: pCONus allows controlled coil occlusion of WNBA, both ruptured and unruptured. Major complications are rare.
Author Disclosures:
M. Aguilar-Pérez: Consultant; Phenox, Covidien, ab medica. **W. Kurre:** Consultant; phenox. **H. Henkes:** Consultant; Phenox, Covidien, Codman, Balt. Founder; co-founder of phenox.

B-0714 10:57

Leptomeningeal collaterals in patients with proximal middle cerebral artery occlusion are associated with shorter thrombus length and lower thrombus burden

C.R. Trampedach, C. Ovesen, A. Christensen, H. Christensen; *Copenhagen/DK (ctramp111@yahoo.com)*

Purpose: Proximal middle cerebral artery occlusions (M1 occlusion) are often but not always associated with severe stroke and poor outcome. The presence of leptomeningeal collaterals can potentially reduce the acute ischemia and thus reduce stroke severity. Occlusions and collaterals can be assessed using computed tomography angiography (CTA). We assessed if leptomeningeal collaterals covariate with the length of the thrombus and a thrombus burden score.
Methods and Materials: Eighty-one patients - subsequently diagnosed with a M1 occlusion on CTA - were admitted within 4.5 hours after symptom onset between May 2009 and December 2011. Occlusions and leptomeningeal collaterals were evaluated on CTA; collaterals were scored according to the amount of collateral supply filling the occluded middle cerebral artery territory.
Results: Eighty-one patients with a single M1 occlusion were included into the analysis (60.5% female, 39.5% male, mean age 69 years, range 29-93 years). There was no correlation between age and collateral score. Median thrombus length at time of admittance was 15 mm (range 2-33), which correlated to the collateral score (R= -0.376, p < 0.001). Median thrombus burden score was 4 (range 0-8) and a correlation with the collateral score was present (R=0.446, p < 0.001).
Conclusion: Leptomeningeal collaterals on CT angiography relate to a shorter proximal middle cerebral artery occlusion and a lower thrombus burden score.

B-0715 11:06

Leptomeningeal collaterals in patients with proximal middle cerebral artery occlusion are associated with milder stroke and better functional outcome after fibrinolysis

C.R. Trampedach, C. Ovesen, A. Christensen, H. Christensen;
Copenhagen/DK (ctramp111@yahoo.com)

Purpose: Proximal middle cerebral artery occlusions (M1 occlusion) are often associated with severe stroke and poor outcome. The presence of leptomeningeal collaterals can potentially reduce the acute ischemia and thus reduce stroke severity. Occlusions and collaterals can be assessed using computed tomography angiography (CTA). Collaterals were scored according to the amount of collateral supply filling the occluded middle cerebral artery territory. We assessed the hypothesis that leptomeningeal collaterals covariates with National Institutes of Health Stroke Scale (NIHSS) at time of admission and with 3 month outcome after acute ischaemic stroke.
Methods and Materials: Fifty-eight patients - subsequently diagnosed with a M1 occlusion on CTA - were admitted within 4.5 hours after symptom onset between May 2009 and December 2011. All patients were scored according to NIHSS on admittance by a stroke-neurologist. Occlusions and leptomeningeal collaterals were evaluated on nonenhanced CT and CTA. All patients received fibrinolysis. Outcome was assessed by modified Rankin Scale (mRS) at 3 months.
Results: Fifty-eight patients with a M1 occlusion were included (57% female, 43% male, mean 70 years, range 42-93 years). There was no correlation between age and collateral score. Median NIHSS at time of admittance was 15 (range 3-25), which correlated to the collateral score ($R=-0.422$, $p < 0.001$). Median mRS at 3 months was 3 (range 0-6) and a correlation with the collateral score was present ($R=-0.361$, $p=0.007$).
Conclusion: Leptomeningeal collaterals on CT angiography relate to lower NIHSS on admission as well as less handicap after 3 months.

B-0716 11:15

Predictors of neurological deficit after endovascular treatment of cerebral arteriovenous malformations and functional repercussion in prospective follow-up

J.C. Llibre, J.A. Jordan; *La Habana/CU (pereraelianne@infomed.sld.cu)*

Purpose: Endovascular therapy is a well established approach to treatment of cerebral arteriovenous malformations (AVMs). The objective of this study was to determine predictive factors of neurological deficit following its application.
Methods and Materials: 71 patients with cerebral AVMs, having undergone 147 embolisation sessions from 2006 to 2011 were followed up prospectively (average of 31, 1 ± 17, 5 months). Functional neurological condition was documented by means of the modified Rankin scale.
Results: Factors found to be predictors of neurological deficit were the partial obstruction of drainage veins (OR=197.6; IC=2.76-1416.0; P=0.015), a positive result in the Propofol test (OR=50.2; IC=6.18 - 566.5; P=0.000), AVM diameter under 3 cm (OR=21.3; IC:1.71-265.6; P=0.018), the presence of intranidal aneurysms (OR=11.2; IC=1.09 -114.2; P = 0.042), the absence of postprocedure hypotension (OR=10.2; IC=1.35-77.7; P=0.003), deep venous drainage (OR=7.14; IC=1.15 - 44.4; P =0.035), and devascularisation in excess of 40% per session (OR=3.3; IC=1.11 - 16.8; P=0.056). 56 patients (78, 9%) did not experience changes in their neurological condition after the treatment and 13 patients (18, 3%) showed a new neurological deficit related to the treatment. 95.8 % of the patients did not show significant long term incapacity.
Conclusion: Partial obstruction of drainage veins, small AVMs, intranidal aneurysms, faulty hemodynamic control and extensive devascularisation were found to be predictors of neurological deficit. A significant number of patients with neurological deficit improved in the long term.

B-0717 11:24

Angiographic reconstructions from whole-brain perfusion CT for the detection of large vessel occlusion and recanalisation in acute stroke

J. Zhang, D. Geng; *Shanghai/CN (zhj81828@163.com)*

Purpose: The aim of this study is to assess the value of angiographic thin-slice volume perfusion CT reconstructions for the detection of intracranial large vessel occlusion and recanalisation after receiving intravenous thrombolytic therapy in patients with stroke.
Methods and Materials: Twenty-five patients with acute cerebral infarction treated by recombinant tissue plasminogen activator (rt-PA) were enrolled in this study. They all underwent admission and 24-hour whole-brain perfusion CT. All images were obtained on a 256-slice multidetector CT scanner. Dynamic 3D CT angiographic images (4-dimensional CTA) generated from perfusion source data were obtained in all patients. Images were assessed for the presence of intracranial vessel recanalisation. The cerebral hemodynamics changes in distribution of ischemic lesions were analysed on perfusion parameter maps.
Results: Of 25 patients with an infarct on follow-up imaging, 19 had infarcts in the middle cerebral artery territory, 5 had infarcts in the posterior cerebral artery territory, and 1 had an infarct in the internal carotid artery territory. Average image quality scoring of baseline CT angiography (CTA) was the same as one of 24-hours volume perfusion CTA (VPCTA) ($P > 0.05$), 4 cases with middle cerebral artery occlusion and one case with internal carotid artery received partial recanalisation on 24-hours VPCTA.
Conclusion: In acute stroke, whole-brain PCT may be an optimal method to evaluate patients for thrombolysis, detect intracranial arterial recanalisation of cerebral arteries after receiving intravenous thrombolytic therapy, and have the potential to decrease radiation dose and contrast media by substituting for intracranial CTA in stroke CT.

B-0718 11:33

TRICKS MRA in the follow-up of coiled aneurysms: preliminary evaluation

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Naples/IT (carmine.sicignano@gmail.com)

Purpose: To evaluate the clinical utility of Time-Resolved Imaging of Contrast KineticS (TRICKS) in MR for the follow-up of patients that underwent endovascular treatments for intracranial aneurysms.
Methods and Materials: From June 2008 to December August 2013 156 patients (with 161 aneurysms endovascularly treated) underwent simultaneous TOF (Time Of Flight) and TRICKS MRA (Magnetic Resonance Angiography) as follow-up of endovascular treatment of intracranial aneurysms (mean: 8 months after treatment, range: 3 to 17 months); DSA (Digital Subtraction Angiography) was performed too, as gold standard (range: 1 to 9 months, mean: 5 months, after MRA). MRA images were analysed independently by 2 senior radiologists and DSA by other two different radiologists. Findings were assigned to 1 of 3 categories: complete obliteration (class 1), residual neck (class 2) and recanalisation (class 3).
Results: TRICKS MRA showed a significantly higher agreement with DSA technique in detecting aneurysm recanalisation compared to TOF-MRI (agreement of 93% vs 75%).
Conclusion: Dynamic MRA in the form of TRICKS is relatively new imaging modality with great potential; if compared to DSA, as in this report, it may represent an efficient option to follow-up patients with intracranial aneurysms treated by endovascular techiniques.

B-0719 11:42

Identification of risk groups in mechanical thrombectomy using the pRESet stent-retriever: are there risk groups for procedure-related complications?

T. Zoubi, R. Dziewas, J. Minnerup, W. Heindel, W. Schwindt, T. Niederstadt;
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Purpose: Mechanical thrombectomy is an established method of recanalisation in patients with acute stroke. Stent-retriever represents a new kind of device. Our purpose was to identify patients with higher risk of periinterventional complications.
Methods and Materials: In our database of 159 interventional treated strokes, we identified 52 patients (ø66±17 yrs) with acute thrombembolic occlusion of MCA who underwent mechanical thrombectomy using the pRESet device (Phenox, Bochum, Germany). In all patients NECT, CTA and PCT were performed immediately before intervention. Grade of recanalisation was measured using the TICI score. Duration of interventional procedure was represented by the time from first diagnostic angiography to revascularisation.
Results: Successful recanalisation (TICI 2b or higher) was achieved in 46 patients (88.5%). 3 patients suffered from vasospams during intervention. In 4 patients thrombembolic complications occurred. Lower density of the occluding thrombus led significantly more often to periinterventional complications (57±5HE vs 66±23HE, p=0.015). Thrombembolic complications occurred significantly more often, if the patients age was ≥75yr (p=0.01). Angio-to-recanalisation time tended to be longer in patients with higher vascular risk score but did not show significance (p=0.086). Thrombus length, number of passes of the device and vascular risk score had no influence on the number of complications.
Conclusion: Mechanical thrombectomy using the pRESet stent-retriever device is an effective method of recanalisation in patients with acute thrombembolic occlusion of MCA. Complications associated with thrombectomy occur, in our study significantly more often in patients with higher age or lower density of thrombus. The dependence of thrombus density and complication rate may originate from thrombus composition.

B-0720 11:51

Can a negative orbital-colour-Doppler-US examination avoid a diagnostic cerebral angiography in patients with a clinical suspect of anterior-draining intracranial-arterio-venous-fistulas?

G. Cristel, M. Venturini, S. Bianchi Marzoli, F. Simionato, G. Agostini, A. Del Maschio; *Milan/IT*

Purpose: Digital subtraction angiography (DSA) represents the gold standard technique to diagnose and treat IAVF. Orbital-colour-Doppler-ultrasound (OCDUS) has already revealed itself to be useful in detecting dilated superior ophthalmic vein (SOV) in patients with IAVF. We investigated whether a negative OCDUS could avoid an invasive diagnostic cerebral angiography in patients with clinical suspect of IAVF.
Methods and Materials: Twenty-two consecutive patients with ophthalmic signs suspecting IAVF were submitted to ophthalmologic examination, OCDUS and DSA. Both eyes were studied with OCDUS (ATL-Philips HDI-5000/IU22, 5-12-MHz linear-probe), performed by the same experienced operator. IAVF diagnosis with OCDUS was based on the finding of SOV with reversed, arterialised, and low-resistance (RI< 0.5) blood flow. Sensibility, specificity, PPV, NPV and accuracy of OCDUS were calculated considering either number of patients and total eyes (total=43), using DSA as gold standard.
Results: Considering the patients, 18/22 were positive at both OCDUS and DSA (DSA demonstrated 18 dural and 2 carotid-cavernous-sinus-fistulas, 2 patients with bilateral involvement) and 4/22 were negative at both; hence, sensibility, specificity, PPV, NPV, and accuracy of OCDUS were all of 100%. Considering the eyes, 24/43 were positive at OCDUS and out of them a IAVF was confirmed in 20/24 cases; 19/43 were negative at both OCDUS and DSA. No false negatives were recorded at OCDUS. Therefore, sensibility, specificity, PPV, NPV, and accuracy of OCDUS, respectively, were 100, 83, 83, 100, and 91%.
Conclusion: Our findings suggest that a negative OCDUS could avoid an invasive DSA in patients with clinical suspect of IAVF.

10:30 - 12:00 **Room L/M**

Cardiac

SS 1303

Myocarditis, storage diseases and diabetes

Moderators:
J. Bremerich; Basle/CH
T. Miszalski-Jamka; Kraków/PL

B-0721 10:30

Post-myocarditis scars underlying ventricular tachycardia: correspondence between delayed-enhanced CMR or MDCT imaging and electroanatomic mapping

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Purpose: The success of catheter ablation guided by electro-anatomic mapping (EAM) in patients with recurrent ventricular tachycardia (VT) depends on the effective identification of myocardial scars. Preablation endocardial EAM with bipolar voltages identifies with high accuracy post-ischemic scars. The identification of post-myocarditis scars at EAM is challenging. The aim of the study was to compare scars at different EAM approaches (bipolar-endocardial, bipolar-epicardial, unipolar-endocardial, unipolar-epicardial) with late enhancement at imaging.
Methods and Materials: Nineteen patients (pts) with post-myocarditis VT were enrolled. 15 pts underwent CMR including post-gadolinium IR-T1w sequences; 4 pts with ICD underwent MDCT including a delayed low-energy (80 kV) scan for scars identification. Scar' site, extension and transmural distribution (subendocardial, mid-wall, subepicardial, transmural) were evaluated at imaging and compared with low voltages suggestive for scars at bipolar and unipolar maps with endocardial and epicardial approach.
Results: 19/19 pts had myocardial scars at LE imaging: in 9 pts, scars involved myocardial wall from epicardium to midwall; in 10 pts, scars involved only subepicardium. Segment per segment correspondence of LE scar localisation with scars at EAM demonstrated that unipolar mapping is more effective in the identification of imaging-revealed scars (71.1% for epicardial map, 24.7% for endocardial map) to bipolar one (63.2% for epicardial map, 1% for endocardial maps).
Conclusion: EAM may identify only upto 70% of post-myocarditis scar substrate underlying VT recurrence. Hence, an imaging based on characterisation of scar substrate should be always performed in these patients before ablation.

B-0722 10:39

Detection of myocardial oedema in acute myocarditis with diffusion-weighted imaging

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Purpose: To evaluate DWI detection capability of myocardial oedema in patients with acute myocarditis in comparison to black-blood STIR (BB-STIR) and its accuracy in combination with delayed gadolinium enhancement (LGE) for the diagnosis of acute myocarditis.
Methods and Materials: 24 patients (19 men and 5 women; mean age 37.4±15.54 years) with confirmed acute myocarditis were prospectively submitted to cardiac MRI with high field scanners (1.5 and 3 Tesla) using short-axis BB-STIR, LGE and whole cardiac DWI. We performed a SS-EPI-DWI sequence with two b values (0 and 300 s/mm2) with cardiac and respiratory triggering during the diastolic phase. Two readers with 14 and 2 years of experience reading cardiac MRI, blindly analyse the studies in two different sessions: BB-STIR+LGE and DWI+LGE. Quality assessment of DWI sequences was also performed (susceptibility and respiratory artefacts).
Results: The combination of BB-STIR and LGE demonstrated a sensitivity and PPV of 100% for reader 1, 86% and 95.3% for reader 2, respectively. The combination of DWI and LGE demonstrated a sensitivity and PPV of 95.6% and 100% for reader 1, 95.6% and 95.3% for reader 2. There were no significant differences in the evaluation of myocardial oedema and the extension of the disease between both techniques (p> 0.05).
Conclusion: DWI with high b value is able to detect myocardial oedema in patients with acute myocarditis in a similar manner to BB-STIR. The combination of DWI and delayed enhancement shows similar sensitivity and PPV for the diagnosis of acute myocarditis compared to BB-STIR and late enhancement.
Author Disclosures:
J. Sanchez-Gonzalez: Employee; Philips Healthcare. Equipment Support Recipient; Philips Healthcare.

B-0723 10:48

MRI findings in acute myocarditis and short-term clinical outcome

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Purpose: The aim of our study is to describe the most frequent and typical MRI findings in acute myocarditis and to evaluate if these MRI findings correlate with the severity of the disease and the short-term clinical outcome.
Methods and Materials: We evaluated MRI imaging findings in 32 patients with a clinical diagnosis of myocarditis. We also evaluated their clinical outcome 6 months and one year after the acute onset of symptoms.
Results: Delayed gadolinium enhancement was present in 69% of patients on the acute phase. The lateral left ventricular wall was the most frequent segment involved. Subepicardial focal enhancement was the most typical finding, present in 55% of patients, whereas 25% presented with intramyocardial focal enhancement and 15% with lineal subepicardial enhancement. Only 5% of these patients showed pericardial enhancement. 58% of patients with late enhancement showed T2 hyperintensity due to oedema. 17% of patients presented with wall motion abnormalities. Left ventricular telediastolic volume was slightly impaired in 2 patients, with complete recovery on cardiac ultrasound two weeks after the acute episode. Left ventricular function was preserved in all patients. Five months after the onset of symptoms, all 6 patients who underwent a second MRI showed persistent enhancement. Only 1 patient had persistent T2 hyperintensity.
Conclusion: We did not find any significant relationship between the presence of delayed gadolinium enhancement and left ventricular function impairment and also we did not find any significant relationship between the presence of gadolinium enhancement in the acute phase and short-term clinical outcome.

B-0724 10:57

Cardiac magnetic resonance evaluation of right ventricle (RV) volumetric and functional parameters in thalassaemia major patients: does the iron affect the RV?

F. Pitocco[1], I. Di Giampietro[1], C. Liguori[2], A. Moscariello[1], A. De Vivo[1], M. Romano[1], F. Sorrentino[1], B. Beomonte Zobel[1]; [1]*Rome/IT*, [2]*Naples/IT (F.Pitocco@unicampus.it)*

Purpose: [TM] patients could present a right heart involvement characterised by RV failure related to chronic anaemia. It is still unknown if iron myocardial deposition and iron overload can influence RV volume and function. Our aim was to define the differences in volumetric and functional parameters between patients with and without myocardial iron overload
Methods and Materials: We enrolled 150 [TM] patients (mean age 37.8 ± 12.8 ys; mean body surface area Kg/m2 1.64±0.24) who underwent to CMR for functional LV-RV evaluation and LV iron assessment. All patients were under iron-chelation therapy and none presented clinical or instrumental signs of

pulmonary hypertension or other cardiovascular comorbidity. RV volumes, ejection fractions and masses were assessed. All parameters were indexed to BSA
Results: We divided our population in patients with (T2*< 20 ms) and without (T2*> 20 ms) iron overload; 21% of TM patients showed myocardial iron overload. We observed significant differences between the two groups in: RVEF, stroke volume, end-systolic and end-diastolic volumes ($p < 0.01$), characterised by RV higher volumes and RV-EF impairment in subjects with cardiac siderosis. No significant differences in RV mass were observed
Conclusion: Cardiac siderosis can be associated with RV dysfunction and can be considered as a contributor to heart failure in TM patients. These data must be kept in mind in course of CMR for a correct clinical evaluation and management in this setting of patients

B-0725 11:06

Cardiac magnetic resonance comparison of cardiac left-right ventricular volumetric and functional parameters in thalassemia major and thalassemia intermedia

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Purpose: T2*CMR is considered the most useful imaging technique to non invasively assess myocardial iron overolad in Thalassemia patients.Our aim was to assess myocardial iron overload in TM and TI patients,the relationship between myocardial T2*values,LV-RV volumetric and functional parameters in the two phenotypes of disease and to analyse differences in volumetric-functional parameters
Methods and Materials: 207 Patients (157TM-50TI; mean age 37.8 ±12.8 ys; mean Body Surface Area Kg/m2 1.64±0.24)underwent CMR examination (Scanner 1.5 T,Avanto,Siemens-Germany). Myocardial iron load was evaluated by T2*measurements;Volumes and Ejection Fractions were analysed using the Steady State Free Precession (SSFP) sequences. All parameters were indexed to body surface area.All TM patients were under iron-chelation therapy and blood transfusion support despite of TI subjects.None presented clinical or instrumental signs of pulmonary hypertension or other cardiovascular comorbidity
Results: TI patients showed no cardiac iron overload whereas in 21% of TM cardiac overload was found.In TI subjects not significant correlation was detected between cardiac T2*and LV-RV volumetric-functional modifications.Only in TM subjects statistically significant ($p < 0.05$)association between myocardial T2*and LV-RV End diastolic-systolic Volumes was found;a significant correlation between T2* values and EFLV-EFRV was noted. Between TM and TI subjects a significant difference was noted in indexed values of Stroke Volumes,Systolic Volumes,Diastolic Volume of LV-RV.No relationship between cardiac mass modifications and T2* was found.
Conclusion: Myocardial iron overload is linked to a deterioration of biventricular function and to an enlargement of LV-RV volumes in TM patients while not significant relation with same parameters can be expected in TI subjects mainly according to absence of cardiac iron load.

B-0726 11:15

Inter-observer reproducibility improvement of myocardial iron T2* calculation using CNR-optimised composite image

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Purpose: Manual myocardial contouring contributes variability to the determination of cardiac iron by T2* MRI. We evaluate the calculation of Myocardial T2* by using CNR-optimised composite images on inter-observer variability of myocardial contour determination.
Methods and Materials: 36 short-axis slices from bright-blood T2* scans of 21 patients (9 hematological and 12 suspected of cardiomyopathy) were acquired at 8 TEs (2.59-18.20 ms, 2.23 ms increment). Four independent observers drew free-hand contours of left ventricular epicard and endocard on one selected image and one CNR-optimised composite image per slice. The CNR-optimised composite image was made by blending three TE images with optimum CNR between the myocardium and its surrounding regions. The calculated minimum mean myocard T2* values, determined for all segments (i.e. 4-6 values per slice), varied between 7.05-36.75 ms. Dice Similarity Coefficient (DSC) was used to assess similarity between observer's contours in the two methods.
Results: Inter-observer agreement in all images (n=216) was improved in the contouring of the CNR-optimised composite image (DSC of 0.844±0.032 median absolute deviation) compared to the subjectively-chosen image (0.811±0.045), $p < 0.001$. In the presence of myocardial iron accumulation, defined as T2*< 20 ms in at least one segment, the composite image also showed significantly better contour agreement (0.842±0.032) compared to the subjectively-chosen image (0.822±0.044), $p < 0.001$ (n=84). Furthermore, inter-observer agreement of myocardial T2* improved when using the composite image (r=0.956) rather than the subjectively-chosen image (r=0.915), $p < 0.001$.
Conclusion: The CNR-optimised composite image improves inter-observer reproducibility of myocardial T2* calculation as a measure of iron deposition, by producing more consistent myocardial contours.

B-0727 11:24

Prevalence and clinical impact of left ventricular noncompaction (LVNC) in β-thalassaemia patients: a cardiac magnetic resonance evaluation

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Purpose: LVNC is a congenital disorder, characterised by multiple and deep trabeculations and a thickened ventricular myocardium with two distinct layers, compacted and noncompacted. LVNC has been linked to several congenital disorders while acquired cases have been described as "isolated LVNC". Its prevalence is < 0.14% in adults referred for echocardiography. Few cases of isolated LVNC in haematological disorders have been described. Our aim was to assess LVNC prevalence in β-thalassaemia patients and to evaluate its potential association with cardiac siderosis
Methods and Materials: We evaluated 300 patients with β-thalassaemia presenting for cardiac iron assessment by MRI. No patients had neuromuscular or congenital heart diseases. 25% patients had myocardial iron overload (T2*< 20 ms). Left-right ventricular volumes, masses and ejection fractions were indexed to the body surface area. A LVNC diagnosis was established according to the following criteria: (a) segmental LV wall thickening with a thin compacted layer; (b) noncompacted vs compacted wall thickness ratio > 2.5;(c) end-diastolic compacted layer < 4.5 mm
Results: 34% patients fulfilled criteria for LVNC. There were no statistically significant differences between patients with and without LVNC in cardiac functional performance (ejection fraction; volumes). These data were confirmed also comparing subjects with < 2 segments on LVNC vs > 2 segments
Conclusion: β-thalassaemia patients present a higher prevalence of LVNC than normal population, in absence of conventional risk factors. A genetical correlation between thalassaemia mutation and ineffective myocardial development could be hypothesised. LVNC myocardium can be considered a new feature to look for in course of cardiac MRI in thalassaemia studies

B-0728 11:33

Diagnostic value of late-enhanced multi-detector computed tomography acquisition in cardiac amyloidosis

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Purpose: Evaluate diagnostic value of late-enhanced Multi-Detector Computed Tomography acquisition in cardiac amyloidosis.
Methods and Materials: Fifteen patients with amyloidosis (10 Transthyretin Familial and 5 AL amyloidosis) and evidence of cardiac involvement on MRI, and 12 control subjects, were included in this prospective study. All subjects were scanned with a 128-slice MDCT. The protocol included a prospective triggering and a delayed acquisition performed 5 minutes after injection of contrast medium. Myocardial volume and mean myocardial density of left ventricle (LV) were calculated from manual contouring of LV boundaries. Region-of-interests were placed in the LV cavity and in the air outside the patient in order to calculate blood density, myocardial signal-to-noise ratio (SNR_{myoc}), blood SNR (SNR_{blood}) and contrast-to-noise ratio (CNR) between myocardium and blood within LV cavity ($CNR_{myoc-blood}$).
Results: Myocardial density and SNR_{myoc} were significantly ($P < 0.05$) higher in patients with cardiac amyloidosis than in control subjects (117 ± 38 vs. 81 ± 16, and 6.55 ± 2.8 vs. 4.88 ± 1.8). SNR_{blood} didn't exhibit significant difference between amyloidosis versus control subjects (8.10 ± 3.1 and 7.69 ± 3.0; P=0.7). $CNR_{myoc-blood}$ of amyloidosis patients was significantly lower comparing to control subjects (1.55 ± 0.9 and 2.82 ± 1.3; $P < 0.05$). LV volume was higher in amyloidosis patients (67 ± 46 mL) than in control patients (50 ± 28 mL) but the difference was not statistically significant (P=0.28).
Conclusion: Late-enhanced MDCT can detect abnormal myocardial enhancement in patients with cardiac amyloidosis and could prove useful in patients requiring permanent pacing, contraindication for MRI.

B-0729 11:42

Predictors of arrhythmic events during the acute phase of hemodynamically stable myocarditis: a cardiac magnetic resonance study

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Purpose: We searched for imaging predictors of arrhythmic events in patients with hemodynamically stable acute myocarditis.
Methods and Materials: There were 103 patients (pt) with hemodynamically stable acute myocarditis. All of them were hospitalised from the E.R. in one of the 3 centres (ICH Rozzano, P.O. Desio, Mater Domini Castellanza). Acute myocarditis was diagnosed with MR in the presence of oedema and LGE. Clinical, bioclinical, ECG and imaging data were reviewed by a panel consensus of 1 cardiologist and 1 radiologist to adjudicate events.
Results: 80 males (77.67%) and 23 females (22.33%), 95% in NYHA class I. Mean EF = 58.6% ±10. During hospitalisation in 14 pz (13.6%) were observed arrhythmic events including 1 torsades de pointes, 4 NSVT, and 1 sustained VT. Only a reduced (i.e.: below normal reference range for MR studies) LVEF was significantly associated with events, with OR = 8.4. Neither WBC count (OR 1.14), troponin peak (OR=1.18), end-diastolic volume (OR=1.0), Late Gadolinium Enhancement mass (OR=1.06) or T2 STIR edema mass (OR=1.2) were related to arrhythmic events during the acute phase of myocarditis.
Conclusion: In hemodynamically stable patients hospitalised for acute myocarditis, clinical events are mainly arrhythmic with a prevalence of 13.5%. A reduced LVEF, evaluated with MR, is the only parameter associated with clinical events during the acute phase of the disease.

B-0730 11:51

Diabetic cardiomyopathy: a cardiac magnetic study on progression of function impairment

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Purpose: Diabetic cardiomyopathy (DCM) is a complication of diabetic mellitus and is characterised by high morbidity and mortality. It consists in a progressive impairment of diastolic and systolic ventricular performance not related to ischemic disease. The aim of our study was to explore with Cardiac Magnetic Resonance (CMR) the alterations in myocardial contractility and geometry in a cohort of selected patients over a four-year follow-up.
Methods and Materials: 34 men with CMR findings suggestive of DCM (increased angle of ventricular torsion,reduced myocardial strain,increased LV mass, slightly increased end-diastolic volume[EDV] and concentricity index[LV mass/ EDV]) performed a 4-year follow-up CMR study. All images were analysed to assess EDVi, end-systolic volume (ESV), ejection fraction (EF), myocardial mass index (LVMi), myocardial strain and ventricular torsion.
Results: Results revealed a decrease of myocardial strain (σ from -12.6% to -10.9%, p=0.03), a non-significant increase of torsion angle (from 19.1°to 19.2, p=0.76), an increase of LVMi (from 132 g/m2 to 118.52 g/m2; p=0.014) and a mild increase of EDVi (from 65.7 ml/m2 to 60.53 ml/m2, p=0.056) at follow-up. The EF was unchanged (from 60.8% to 58.9%) and the concentricity index showed no significant changes (from 2.1 g/ml to 2.0 g/ml, p=0.51). Metabolic parameters showed no significant differences in glycemia and glycosylated hemoglobin.
Conclusion: Early features of DCM are contractile dysfunction, increased global angle of twist and LV concentric hypertrophy. A progressive dissociation between myocardial contraction and ventricular torsion characterise late dilative stages.
Author Disclosures:
N. Galea: Research/Grant Support; Grant from FIRB project 2010 - "Futuro in Ricerca" program (Protocol No RBFR10URHP_003) of Italian Ministry of Education, University and Research.

10:30 - 12:00 **Conf. Room M3**

Interventional Radiology

SS 1309

New techniques and applications

Moderators:
T. Andrasina; Brno/CZ
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B-0731 10:30

MR-guided laser-induced interstitial thermotherapy of liver metastases from breast cancer and other non-colorectal liver metastases: prognostic factors for overall survival and progression-free survival

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Purpose: To retrospectively evaluate prognostic factors for progression-free survival (PFS) and overall survival (OAS) after treatment of liver metastases from breast cancer and other non-colorectal cancers with MR-guided laser-induced thermotherapy (LITT).
Methods and Materials: 401 patients (58 males, 343 females; mean age 57.3 years) with liver metastases from different primary tumours (breast cancer n=271, neuroendocrine cancer n=21, others n=109) were treated with MR-guided LITT between January 2000 and January 2011.
Results: Median OAS of all patients was 37.6 months starting calculation from the date of first intervention with LITT. 1-year survival was 86.5%, 2-year survival 67.2%, 3-year survival 51.9%, 4-year survival 39.9%, and 5-year survival 33.4%. In patients with liver metastases from breast cancer, 1-year OAS was 86.7%, 2-year OAS 66.9%, 3-year OAS 51.5%, 4-year OAS 40.3%, and 5-year OAS 32.1% (median 37.6 months). 1-year PFS was 50.3%, 2-year PFS 36.3%, 3-year PFS 28.4%, 4-year PFS 24.5%, and 5-year PFS 19.9% (median 12.2 months). In patients with liver metastases from neuroendocrine cancer 1-, 2- and the 3-year OAS rates reached 94.1%, 72.1% and 51.5%, respectively (median 36.6 months). 1-year PFS was 50.6%, 2-year PFS 33.8%, 3-year PFS 26%, 4-year PFS 20.4% and 5-year PFS 17% (median 12.2 months).
Conclusion: MR-guided LITT of liver metastases from breast cancer and other non-colorectal cancers results in a good OFS and PFS rates in comparison to hepatic resection and other therapies. For both groups, the initial number of metastases and their volume can be seen as the most important prognostic factors for clinical success.

B-0732 10:39

MRI T1 treatment-monitoring during laser-induced thermotherapy of hepatic metastases for necrotic size prediction

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Purpose: To investigate the accuracy of real-time MRI T1-based treatment-monitoring for predicting lesion volume during laser-induced thermotherapy (LITT) of hepatic metastases.
Methods and Materials: 237 liver metastases in 151 patients were ablated during 372 LITT procedures. 1.5 T MRI treatment-monitoring using longitudinal relaxation time (T1) FLASH sequences was performed. Patients underwent additional contrast-enhanced MRI directly after LITT, 24h after ablation and during follow-up at 3, 6 and 12 months. The applied energy necessary for full ablation within the various liver segments was investigated.
Results: Total amount of applied energy during LITT varied from 6.12 to 225.32 kJ (mean: 48.96 kJ) and peaked in the liver segments 5 (2.12 kJ/cm³) and 8 (2.16 kJ/cm³). The preablative metastasis volume ranged from 0.5 to 51.94 cm³ (mean: 1.99 cm³; SD: 25.49 cm³) while the volume measured in the last available T1 image varied from 1 to 120 cm³ (mean: 26.25 cm³; SD: 25.66 cm³). Volumes measured via T1-based treatment-monitoring showed a stronger correlation with necrosis 24 h after LITT ($r = 0.933$; $p < 0.001$) than contrast-enhanced MRI directly after the procedure ($r = 0.888$; $p < 0.001$).
Conclusion: Real-time MRI T1 treatment-monitoring during LITT of hepatic metastases enables precise estimation of the resulting lesion volume and improves control of the energy necessary during ablation.

B-0733 10:48

Initial clinical experience with a quadrupole butterfly coil for spinal injection interventions in an open MRI system at 1.0 Tesla

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Purpose: To report our initial clinical experience with a new MRI quadrupole coil which allows interventions in prone position.
Methods and Materials: Fifteen patients (7 women, 8 men; average patient age 42.8 years) were treated in a 1.0 Tesla Panorama High Field Open (HFO) MRI system (Panorama HFO) using a quadrupole butterfly coil (Bfly) and compared with 15 patients matched for sex, age, and MR intervention using the MultipurposeL coil (MPL) performed in conventional lateral decubitus position (all, Philips Medical Systems, Best, The Netherlands). All interventions were performed with a near-real-time proton density turbo spin echo (PD TSE) sequence (TR/TE/flip angle/ta: 600 ms/ 10 ms/ 90°/ 3 s/image). Qualitative and quantitative image analysis was performed including signal intensity, signal-to-noise and contrast-to-noise ratio (SNR, CNR), contrast and full width at half maximum (FWHM) measurements.
Results: Contrast differed significantly between the needle and muscles (Bfly 0.27/MPL 0.17) as well as the needle and periradicular fat (0.13/0.24) during the intervention (both, p=0.029), as well as CNR between muscles and the needle (10.61/5.23;p=0.010) although the FWHM values did not (2.4/2.2;p=0.754). Signal intensity of the needle in interventional imaging (1152.9/793.2;p=0.006), and postinterventional SNR values of subcutaneous fat (15.3/28.6;p=0.007), muscles (6.6/11.8;p=0.011), and the CNR between these tissues (8.7/17.5;p=0.004) yielded significant differences.
Conclusion: The new coil is a valid alternative for MR-guided interventions in an open MRI system at 1.0 Tesla, especially if patients cannot (or prefer not to) be in a lateral decubitus position, or if prone positioning yields better access to the target zone.

B-0734 10:57

Single centre experience of extending indications for percutaneous intraportal pancreatic islets auto-transplantation after pancreatic surgery to prevent type-1 diabetes: feasibility, technical aspects, complications, and clinical outcome

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Purpose: Percutaneous islet allo-transplantation, needing immunosuppression, is a traditional less invasive alternative to surgical pancreas transplantation for brittle-type-1 diabetes, while PIPIAT, not needing immunosuppression, is usually performed after pancreatic surgery for chronic pancreatitis to prevent diabetes. Our aim was to assess feasibility, technical aspects, complications and clinical outcome of PIPIAT following pancreatic surgery, not only for chronic pancreatitis but also for benign and malignant nodules.
Methods and Materials: From 2008 to 2012, 41 patients were enrolled for PIPIAT 24/48 hours after pancreatic surgery (total pancreatectomy, distal pancreatectomy for benign/borderline neoplasms of pancreatic body-neck). PIPIAT was performed using a combined US and fluoroscopy-guided technique (4-F catheter): PIPIAT feasibility, complications, median-follow-up, metabolic (insulin independence rate, graft function based on β-score, marker of islet function) and oncologic (malignant and metastatic diseases) outcomes were recorded.
Results: PIPIAT wasn't performed in 7/41 patients (4 for inadequate islet mass, 2 for hemodynamic instability, 1 for islet culture contamination), while it was successfully performed in 34/34 patients. PIPIAT-related complications occurred in 8 patients (23.5%): 4 bleedings (2 requiring transfusions), 3 portal thromboses (1 complete, 2 partial), 1 sepsis. Median follow-up duration was 546 days. Insulin independence was achieved in 15/34 patients (44%), partial graft function in 16/34 patients (47%), no function in 3/34 patients (6%). Seventeen patients had malignancy; none of them developed liver metastases during follow-up.
Conclusion: PIPIAT, performed under a combined US and fluoroscopy guidance and not requiring immunosuppression, is feasible, with a relatively low complication rate and a better metabolic outcome than allo-transplantation.

B-0735 11:06

Safety and mild-term permeability of ePTFE-covered portosystemic shunts (TIPS) in children

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Purpose: To analyse retrospectively the safety and efficacy of ePTFE-covered TIPS in children.
Methods and Materials: We present 12 children (average-age 9 and weight 30 kg)who received implants of 10-mm-diameter Viatorr ePTFE-covered endoprostheses for acute (n=7) or recurring upper-gastrointestinal bleeding (UGB) (n=4) caused by medically or endoscopically uncontrollable varices. All the children had liver disease of differing causes, three with chronic portal thrombosis and cavernomatosis. The recurrence of UGB, associated complications and permeability were assessed with Doppler ultrasound sequentially or up to transplantation.
Results: In all the children, a single endoprosthesis was implanted in a single session, without mortality. The mean initial transhepatic gradient was 15 mmHg (3-21 mmHg), which dropped to 7 mmHg (1-12 mmHg) after TIPS implant. Immediate complications observed were mild encephalopathy (1) and acute occlusion TIPS (1) which was resolved with the implant of a coaxial endoprosthesis. Stenosis of the TIPS (1) was observed at 9 months and two complete thrombosis was observed: portal cavernomatosis of a liver transplantation at 7 months and another one at 12 months; all were resolved with angioplasty and coaxial endoprostheses. Four children received transplants at 7- 9-10-17 months, with permeability of the TIPS observed. In the other eight, permeability was demonstrated with Doppler ultrasound during a mean follow-up period of 18 months (primary permeability=67% and secondary permeability=100%).
Conclusion: Our results indicate the safety and permeability of Viatorr ePTFE-covered endoprostheses for the treatment of UGB due to gastroesophageal varices can be good, a fact that needs to be corroborated with larger series in the future.

B-0736 11:15

Percutaneous transhepatic cholangioscopic lithotripsy for the treatment of intrahepatic stones

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Purpose: To assess the safety and effectiveness of percutaneous transhepatic cholangioscopic lithotripsy (PTCSL) for the treatment of hepatolithiasis in hostile abdomen.
Methods and Materials: From January 2011 to July 2013 we assessed 43 patients who underwent PTCSL. All patients performed pre-operative CT and/or MRCP to assess the location of intrahepatic stones and post-operative anatomy. PTCSL was performed using 2.8-mm cholangioscope (Olympus CHF CB30/S) with electrohydraulic shock-wave lithotripsy probes. This was performed through a biliary percutaneous access previously obtained by inserting a biliary drainage (10 Fr). After the procedure, a biliary catheter was left in place to make a cholangiographic follow-up.
Results: All patients had prior complex hepatobiliary operations (i.e. duodenocefalopancreasectomy). The median duration of the condition prior to PTCSL was 6 (3-12) months. In all cases, stones were fragmented during the first procedure. There was minimal intraoperative blood loss. Median size of bile duct was 15 mm prior to the procedure. The number of stones ranged from one to five with the largest size of stone comparable to the size of bile duct. The median follow-up was 12 months. Forty-one patients were symptom free with neither stone recurrence nor cholangitis immediately after the procedure or during follow-up. No bleeding or deaths were encountered. Only two patients had a transient episode of cholangitis with fever and chills immediately after the procedure.
Conclusion: PTCSL is a feasible and an effective treatment method for patients with recurrent biliary stone, following complex abdominal surgery as the success rate from endoscopic procedures is limited.

B-0737 11:24

Ozone augmented percutaneous discectomy: a novel minimally invasive alternative to surgical discectomy in patients with refractory discogenic sciatica?

M.T. Crockett, M. Moynagh, N. Long, K. Synnott, S. Eustace; *Dublin/IE (crockettmt@gmail.com)*

Purpose: Discogenic sciatica is a prevalent and debilitating condition. Multiple minimally invasive treatment options are available with none demonstrating definitive equality or superiority to surgical discectomy. Automated percutaneous discectomy and intradiscal ozone therapy are established minimally invasive treatment options which have shown promise in cohorts of patients in whom first line therapies have failed. The purpose of this study was to assess the safety and efficacy of a novel combination treatment option; ozone augmented percutaneous discectomy (OAPD).
Methods and Materials: 100 patients were included in the study, all with a diagnosis of discogenic sciatica confirmed following lumbar spine MRI and examination by a consultant orthopaedic surgeon. All patients had failed first line therapies of 6 weeks physiotherapy and subsequent caudal epidural injection (post treatment McNab score of 1). These patients then underwent combination treatment of OAPD performed by an experienced musculoskeletal radiologist. Patient follow-up ranged from 6-18 months. Outcome measures were McNab clinical outcome score and requirement to undergo subsequent surgical discectomy.

Results: Over 70% of patients recorded significant symptomatic improvement eliminating the requirement for operative intervention whilst the remainder proceeded to undergo surgical discectomy. Average McNab clinical outcome score following OAPD was 3.6. No significant intra or post-procedural complications were recorded.
Conclusion: OAPD is a safe and effective novel minimally invasive treatment option in a cohort of patients with confirmed discogenic sciatica in whom first line treatment options have failed. Further research is required to assess longer term outcomes and to directly compare OAPD with surgical discectomy.

B-0738 11:33

Percutaneous vertebroplasty in adult degenerative scoliosis for spine support: study for pain evaluation and mobility improvement
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Purpose: To evaluate efficacy and safety of percutaneous vertebroplasty (PV) as primary treatment in adult degenerative scoliosis.
Methods and Materials: During the last 4 years, PV was performed in 18 adult patients (68 vertebral bodies) with back pain due to degenerative scoliotic spine. Under anaesthesia and fluoroscopy, direct access to the most deformed vertebral bodies was obtained using 13G needles and PMMA for vertebroplasty was injected under continuous fluoroscopic control. The inner arch of scoliosis was supported. Clinical evaluation included immediate and delayed follow-up studies of patient's general condition and neurological status. A NVS scale on a questionnaire helped assessing pain relief degree, life quality and mobility improvement.
Results: Comparing the patients' scores prior to vertebroplasty (mean value 8.06±1.3 NVS units), the morning after (mean value 3.11±1.2), at 12 (mean value 1.67±1.5) and 24 months post vertebroplasty (mean value 1.67±1.5 NVS units), patients of our study presented a mean decrease of 6.39±1.6 NVS units on terms of life quality improvement and pain relief ($p < 0.001$). Overall mobility improved in 18/18 (100%) patients. No complications were observed. During the follow-up period (mean value 17.66 months) patients underwent a mean of 1.3 sessions for facet joint and nerve root infiltrations.
Conclusion: Percutaneous vertebroplasty in the inner arch seems to be an effective technique for supporting adult degenerative scoliotic spine. It can be proposed as an initial treatment in the scoliosis of the elderly prior to surgery. Preliminary results report significant pain reduction and mobility improvement, but further studies are required.
Author Disclosures:
A. Kelekis: Consultant; Benvenue Medical.

B-0739 11:42

CT-guided screw fixation of vertical sacral fractures in local anaesthesia using a standard CT
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Purpose: To evaluate time efficiency, radiation dose, precision and complications of percutaneous iliosacral screw placement under CT-guidance and local anaesthesia.
Methods and Materials: Retrospective analysis of 143 interventions in 135 patients during a period of 42 months. Implant failures could be evaluated in 85/182 screws and bony healing or refracturing in 46/182 screws.
Results: A total of 182 iliosacral screw placements in 179 vertical sacral fractures (105 unilateral, 37 bilateral) took place in 135 patients. No screw misplacements including the simultaneous bilateral procedures were noted. The average time for a unilateral screw placement was 23 minutes (range: 14 - 52 minutes) and 35 minutes (range: 21 - 60 minutes) for simultaneous bilateral screwing. The dose length product was 365 mGy*cm (range: 162-1014 mGy*cm) for the unilateral and 470 mGy*cm (range: 270-1271 mGy*cm) for the bilateral procedure. In relation to the previous diagnostic CT of the pelvis the dose length product was 0.95 (SD: 0.33) for unilateral and 1.10 (SD: 0.19) for bilateral screws. 1 gluteal bleeding occurred as the only significant acute minor complication (0.7%). Backing out of 12/85 screws occurred between 6 and 69 days after intervention. In 8 patients contralateral stress fractures were detected after unilateral screw placement.
Conclusion: CT-guided iliosacral screw placement in sacral fractures is a safe tool providing a high precision. The radiation dose is in the order of a diagnostic CT of the pelvis for both unilateral and bilateral screws. Contralateral stress fractures in unilateral screw placements must be considered during the first weeks after intervention.

B-0740 11:51

Combined implantation of central venous access ports and percutaneous radiological gastrostomy in patients with malignant disease is feasible and safe
A.R. Keulers, A. Stamm, A.H. Mahnken; *Marburg/DE*

Purpose: To evaluate the feasibility, safety and patient tolerance of combined central venous totally implantable access ports (TIAP) and percutaneous radiological gastrostomy (PRG) implantation in patients with advanced stage malignant disease.
Methods and Materials: From 01/2010 to 07/2013 70 patients (61.7±10.25 years; 54 men, 16 women) underwent fluoroscopy-guided TIAP via the internal jugular vein and PRG during a single session. Indications for port and gastrostomy were advanced malignancy with the need of chemo or radiation therapy. Minor and major-complications during the acute (0-24h), early (1-30d) and late phase (> 30d) were recorded according to the Society of Interventional Radiology classification and analysed retrospectively. As standard of care patients were questioned about their opinion regarding the combined procedure.
Results: For TIAP the following complications occurred: port infection with consecutive explanation (major: n=1; 1.4%), thrombosis (minor: n=1; 1.4%). For PRG one acute complication in terms of insufficient gastropexy followed by CT-guided PRG occurred (n=1; 1.4%). In 69 cases, PRG was successful with no early or late major-complications. Altogether 33 minor complications were noted, 10 in early (14.3%) and 23 in late phase (32.8%). Most minor complications were due to incorrect handling (n=20; 60.6%) resulting in local infection, dislocation or material defect. 94% of the patients preferred the combined intervention over two separate procedures.
Conclusion: Combined TIAP and PRG-implantation is feasible and safe with complication rates comparable to those reported in literature while having an excellent patient acceptance.

10:30 - 12:00 **Board Room A**

Paediatric

SS 1312

New imaging applications

Moderators:
K. Rosendahl; Bergen/NO
I. Sefic-Pasic; Sarajevo/BA

B-0741 10:30

Using intravoxel incoherent motion MR imaging to predict vesicoureteral reflux in children with upper urinary tract infection: preliminary results
J. Kim, C. Lee, Y. Park, J. Lee, J. Choi, K. Kim, C. Park; *Seoul/KR (pridebio@naver.com)*

Purpose: To compare diffusion parameters of intravoxel incoherent motion (IVIM) diffusion-weighted imaging (DWI) between "reflux" and "non-reflux" kidneys, and to evaluate feasibility of IVIM DWI in predicting vesicoureteral reflux (VUR) in children with upper urinary tract infection (UTI).
Methods and Materials: This retrospective study was approved by our institutional review board and the requirement for informed consent was waived. Sixty-three kidneys of 39 pediatric patients with upper UTI were included and classified into "reflux" and "non-reflux" groups according to the presence of VUR on VCUG. DWI using IVIM was performed with eight b factors. ADC, true diffusion coefficient (D), pseudo-diffusion coefficient (D*), and perfusion fraction (F) were measured and compared in renal pelvis of both groups. Four indeces (D*/ADC, F/ADC, D*/D, and F/D) were also calculated and ROC curve analyses were performed for each index to identify optimal cut-off value that can predict VUR.
Results: VURs were detected in 17 kidneys on VCUG. In "reflux" group, ADC values were significantly lower (2.87 ± 0.27vs.$3.15\pm0.39\times10^{-3}$ mm^2/sec, $p=0.004$), and D* and F values were significantly higher than "non-reflux" group (41.50 ± 12.38vs.$30.01\pm10.47\times10^{-3}$ mm^2/sec, $p < 0.001$, and 0.31 ± 0.12vs.0.22 ± 0.14, $p=0.018$, respectively). Four indeces (D*/ADC, F/ADC, D*/D, and F/D) were all significantly higher in "reflux" group than "non-reflux" group ($p=0.004$,< 0.001,< 0.001 and 0.011,respectively). Among them, area under ROC curve for D*/ADC was highest (0.803), and optimal cut-off value of 10.87 corresponded to 82.35% sensitivity and 71.74% specificity for detecting VUR.
Conclusion: D* and F values are significantly higher and ADC values are significantly lower in renal pelvis of "reflux" kidney than "non-reflux" kidney. Our new index (D*/ADC) can be useful for predicting VUR.

B-0742 10:39

Role of noninvasive acoustic radiation force impulse imaging to predict complications in post-liver transplanted paediatric patients

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Purpose: Acoustic radiation force impulse (ARFI) imaging has been developed as a noninvasive ultrasound-based elastography modality to assess graft fibrosis after orthotopic liver transplantation (OLT), estimated as tissue stiffness. This method has attempted to replace periodical biopsy. The aim of this study was to evaluate the clinical utility of ARFI imaging to detect complications after paediatric OLT, in comparison with histopathologic findings.
Methods and Materials: We periodically performed liver stiffness measurements by ARFI imaging in 54 paediatric OLT recipients (evaluated from 1 month to 2 years from the transplantation). In each recipient, the shear-wave velocity (SWV) was measured ten times to quantify hepatic stiffness. Liver biopsy and laboratory analysis (including functional liver markers) were performed in a range of time from one day to one month from the ARFI imaging.Collected data were evaluated retrospectively.
Results: Median SWV was higher in patients with clinical, biochemical and histological signs of graft rejection than in patients without evidence of liver disease [2.13m/s, 95% confidence interval (CI) 1.84-2.42]. Median SWV values in patients with only hepatitis or fibrosis were respectively 1.41m/s (95% CI, 1.25-1.56) and 1.67m/s (95% CI, 1.26-2.07). The median value of the ARFI measurements in normal patients was 1.27m/s (95% CI 1.17-1.36).
Conclusion: ARFI was a reliable, noninvasive and rapid method able to predict the diagnosis of graft disfunction in paediatric OLT. Liver stiffness measurements correlated with histopathologic findings. ARFI could be useful to postpone the time of liver biopsy and guide the immunosuppressive first line therapy.

B-0743 10:48

High temporal versus high spatial resolution in MR quantitative pulmonary perfusion imaging of 2-year-old children after congenital diaphragmatic hernia repair

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Purpose: Congenital diaphragmatic hernia (CDH) leads to lung hypoplasia. Using dynamic contrast-enhanced (DCE) MR imaging, lung perfusion can be quantified. As according to Monte Carlo simulations, MR perfusion values depend on temporal resolution; we compared two protocols to investigate if ipsilateral lung perfusion is impaired after CDH, if simulation results can be confirmed and which protocol should be preferred.
Methods and Materials: DCE-MRI was performed in 36 2-year-old children after CDH on a 3 T MRI system. Protocol A (n=18) based on a high spatial (3.0 s; voxel: 1.25 mm3) and protocol B (n=18) on a high-temporal resolution (1.5 s; voxel: 2 mm^3). Pulmonary blood flow (PBF), pulmonary blood volume (PBV) and mean transit time (MTT) were calculated. Peak contrast to noise ratio (PCNR) was calculated.
Results: Mean PBF was significantly reduced on the ipsilateral side, i.e. for protocol A, PBFipsilateral was 45±26 ml/100 ml/min compared to PBFcontralateral (63±28 ml/100 ml/min; p=0.0016) and for protocol B side-differences were equivalent (PBFipsilateral=62±24 vs. PBFcontralateral=85±30 ml/100 ml/min; p=0.0034). PCNR was significantly higher for protocol B (30±18) than for protocol A (20±9; p=0.0294). Protocol B showed higher values of PBF in comparison to protocol A (p always < 0.05).
Conclusion: In 2-year-old children, after CDH repair ipsilateral lung perfusion is reduced. Higher temporal resolution and increased voxel size show a gain of PCNR and significantly decrease the by Monte-Carlo simulated underestimation of PBF. Protocol B should therefore be preferred, as a 2 mm^3 isotropic voxel resolution is still sufficient to detect side-differences of lung perfusion.

B-0744 10:57

Elastosonography evaluation of testes with varicocele in paediatric patients, preliminary results

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Purpose: To determine whether elastosonography is able to detect differences in the testicular elasticity between normal testes and testes with varicocele.
Methods and Materials: 13 boys (9-13 years old) with untreated varicocele (bilateral in 3 boys and left unilateral in 10) and 12 age-matched healthy subjects underwent elastosonography. Varicocele was classified from a clinical point (*stage I*: palpable only during the Valsalva maneuver - VM; *II*: palpable at rest; *III*: visible at rest) and considering the duration of reflux at Doppler (*short*: detectable only during the VM; *medium*: lasting some seconds after the VM; *long*: independent of the VM). The testicular elasticity was expressed as an arbitrary three-point scale (1: normal; 2: slightly-moderately stiffer than normal; 3: severely stiffer than normal).
Statistical analysis was performed by means of the Student's *t*-test.
Results: The clinical stage of varicocele was I in 2 cases, II in 9 and III in 5; the reflux was short in 3 cases, medium in 6 and long in 7. The elasticity was 1 in all 34 normal testes, 2 in 9 testes with varicocele and 3 in 7. The differences in the degree of elasticity between normal testes and testes with varicocele and between long-duration and medium/short-duration varicocele were both statistically significant ($P < 0.001$); the difference between stage III and stages I/II varicocele was just below significance ($P = 0.053$).
Conclusion: Testes with varicocele are significantly stiffer than normal ones, with a positive correlation to both the clinical stage and the duration of reflux.

B-0745 11:06

Correlation between post-mortem computed tomography and magnetic resonance imaging and autopsy findings in paediatric forensic imaging

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Purpose: To examine the cause of death using imaging in the paediatric population and the agreement between autopsy and imaging findings. To evaluate the feasibility of imaging to determine cause of death to reduce paediatric autopsies.
Methods and Materials: From Jan 2011 to Jan 2013, we performed CT and MRI imaging of 41 cases under 18 years of age. We examined the imaging findings and compared the findings for those autopsied.
Results: Imaging studies were performed for 41 children (average age 4.5 ± 5.4, 34 younger than 10) with 24 (59%) autopsied. CT was performed on 40, combining MRI in 15 and only MRI in one. There were 19 trauma and 22 non-trauma cases. Imaging showed cause of death for the 9 cases autopsied. For 10 cases, cause of death was based on imaging only. For the 22 non-trauma cases, 15 were autopsied (68%). With imaging, pneumonia was cause of death for 18 cases (81% of non-trauma, 44% of total) with 13 (72%) confirmed by autopsy. One autopsy confirmed cause of death was hyperthermia and one aortic rupture. There were complementary findings for imaging and autopsy in 4 cases, not significantly changing the cause of death.
Conclusion: Post-mortem imaging studies should be an inseparable part of the post-mortem examination in all paediatric forensic investigation. Pneumonia is common in non-trauma paediatric death. Once traumatic or criminal involvement has been excluded by imaging, invasive autopsy can be limited.

B-0746 11:15

Quantitative cerebral perfusion imaging at 3.0 T after congenital diaphragmatic hernia repair and ECMO therapy with or without common carotid artery occlusion

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Purpose: To quantify cerebral perfusion in children after congenital diaphragmatic hernia (CDH) repair with right common carotid artery (rCCA) occlusion after extracorporeal membrane oxygenation (ECMO) therapy and to assess whether CCA occlusion leads to impaired cerebral perfusion.
Methods and Materials: Using pulsed arterial spin labelling (pASL; TR/TE 2474.6/21 ms, FOV 210x210 mm^2, section sickness 8 mm, voxel resolution 2.2x2.2x8 mm^3; measurements 60, TI_1 700 ms, TI_2 1800 ms, TI_{1s} 1600 ms; Magnetom Trio, Siemens Healthcare Sector, Germany) cerebral perfusion was evaluated and quantified in 29 2-year-old children (2.1±0.2 years) after CDH repair. In 14 patients, the rCCA was occluded after ECMO therapy. 15 patients without ECMO and normal brain supplying circulation served as controls. 2 cortical (containing cortical gray matter) and subcortical (containing subcortical gray and white matter) ROIs were placed in both hemispheres of each child based on ASL images superimposed with anatomic reference images.
Results: Patients with rCCA occlusion showed significantly lower subcortical perfusion for the right hemisphere with regional cerebral blood flow (rCBF) of 68.8±23.6 vs. 79.1±30.5 ml/100 g/min left-sided, p=0.011. Cortical perfusion showed a trend for reduced perfusion on the right side with rCBF 65.9±24.5 vs. 72.2±29.0 ml/100 g/min, p=0.138. Patients with normal rCCA flow demonstrated identical cerebral perfusion bilaterally (p=0.780 and 0.340). In nearly one third of the children with rCCA occlusion right rCBF was reduced more than 20%.
Conclusion: After ECMO therapy and decannulation, ligation or reconstruction of the CCA can be performed. Based on the possible hypoperfusion of the hemisphere, with no complete collateralisation, reconstruction should be preferred, even if secondary occlusion can occur.

B-0747 11:24

Optimisation of time-resolved CE-MRA of the thoracic vasculature in Fontan patients: a quantitative approach

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Purpose: To optimise first-pass (FP) imaging of the cavo-pulmonary connection in Fontan patients with time-resolved contrast-enhanced MR angiography (TR-MRA) by identifying protocol-related factors that contribute to vessel enhancement.
Methods and Materials: TR-MRA was performed in 38 patients (age:8-44 years, median 16 years) with a total cavo-pulmonary Fontan connection on a 1.5 T MR system using a T1-weighted 3D gradient-recalled echo sequence. K-space was undersampled using a TWIST protocol. TR/TE were 2.8/1.1 ms, and flip angle was 25°. Reconstructed voxel size was 0.78×0.78×1 mm3. Acquisition time per phase ranged from 4.3 to 9.0s. After injection of 0.1 mmol/kg gadobenate dimeglumine (MultiHance, Bracco) at injection rate IR=0.9 mmol/s, 11 phases were acquired. Signal enhancement curves (SE=SI (t)/SIpre) were measured in the pulmonary arteries (PA), superior and inferior venae cavae (SVC and IVC), and the aorta. For each patient, the maximum concentration in the aorta and SVC were estimated using the cardiac output (CO) with Cmax (aorta)=IR/CO and Cmax (svc)=3xCmax (aorta).
Results: During first pass, the Fontan connection could generally not be visualised. Signal enhancement was significantly lower ($p < 0.01$) in the SVC (SE=1.5±0.6) and PA (SE=2.0±1.4) compared to the aorta (SE=4.7±1.1). Estimated Cmax (svc) was high: 18-72 mmol/L. However, no correlation between Cmax and SE was found. In the IVC, SE was 1.2±0.5, resulting in inadequate visualisation.
Conclusion: First-pass TR-MRA of the cavo-pulmonary connection was suboptimal due to a too high concentration in the SVC and resultant image degrading T2* effects and low concentration in the IVC. Initial results demonstrate improved visualisation when contrast injected was in the foot.

B-0748 11:33

Placental diffusion MR imaging findings in intrauterine growth retardation

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Purpose: To investigate diffusion-weighted MR imaging for the diagnosis of placenta in patients with IUGR diagnosis.
Methods and Materials: The study included a total of 70 patients; 32 patients with intrauterine growth restriction, diagnosed via US-Doppler, remaining were non IUGR fetus. All patients were evaluated with diffusion MRI at 3 T MRI unit. ROI values of b0, b1000 and ADC maps applied to the placenta were obtained. The findings were compared with and without the diagnosis of IUGR. In addition, after birth, two groups' prenatal MRI measurements were correlated with birth weights.
Results: ADC values calculated from b0 and b1000 signal intensity values measured in the placenta in cases of IUGR were significantly decreased than those without IUGR. IUGR infants' birth weights were significantly lower than those without IUGR. There were significant correlations among prenatal and birth weight with the diffusion MRI parameters.
Conclusion: Placental diffusion MRI examination can provide an important contribution to the diagnosis of IUGR cases.

B-0749 11:42

3D ultrasound of the femoro-patellar articulation in newborns

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Purpose: To establish a 3D ultrasound screening method of femoro-patellar dysplasia in newborns.
Methods and Materials: From 2012 to 2013, we prospectively imaged 160 consecutive femoropatellar joints in 80 newborns from the 36th to 6 1st gestational week that underwent a hip sonography (Graf) and presented with a type I hip. A paediatric radiologist performed the 3D ultrasound of the femoro-patellar joint in 30° flexion of the knee. Axial, coronal and sagittal reformats were used to standardise a reconstructed axial plane through the femoral condyle and the mid-patella. The sulcus angle, the lateral-to-medial facet ratio of the trochlea and the shape of the patella (Wiberg) were evaluated.
Results: All 3D exams were diagnostic and feasible for reconstructions in a standardised axial plane. The mean trochlea angle was 149.1° with ad STD of 4.9°. There was no statistical difference between boys and girls. The lateral to medial facet ratio of the trochlea ratio was 1.3 with a STD of 0.22. Wiberg type I patella was found in 95% of the babies and type II in 5%.
Conclusion: 3D ultrasound is a reliable technique to image the cartilaginous femoro-patellar joint in newborns. The shape of the femoro-patellar articulation in newborns is already preformed in its adult form, which justifies this screening method for femoro-patellar dysplasia. Performing a 3D ultrasound with standardised reconstructions of the axial plane allows sonographic measurements to be made. This may have the benefit of lower operator dependency.

B-0750 11:51

Ultrasound and elastographic evaluation of the lower urinary tract in patients with hypospadia

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Purpose: To determine whether significant differences exist between patients with hypospadia and normal subjects at conventional ultrasound (US) and elastography.
Methods and Materials: 17 male children (age: 5-10 years) with mid-penile or anterior penile hypospadia and 11 age-matched normal subjects were enrolled. The sagittal diameter of the corpus spongiosum, the sagittal and the transversal diameters of the right corpus cavernosum and the angle between the tangents to the medial surface of the two corpora cavernosa were measured on a transversal US scan on the ventral surface of the proximal penis. The length of the bladder neck and the thickness of the detrusor muscle were also assessed. Real-time sonoelastography of the corpus spongiosum was performed on a longitudinal scan at the ventral surface of the proximal penis; a semi-quantitative 3-point scale (1 = more, 3 = less elastic) was adopted.
Statistical analysis was performed using the Mann-Whitney *U* test.
Results: The patients with hypospadia with respect to the normal subjects had lower sagittal and transversal diameters of the right corpus cavernosum, a wider inter-cavernous angle and a lower elasticity of the corpus spongiosum: all these differences were highly significant ($P < 0.001$). The sagittal diameter of the corpus spongiosum was lower and the bladder neck longer in the patients' group ($P < 0.005$), while no significant differences emerged as for the mean detrusorial thickness.
Conclusion: The patients with hypospadia are significantly different from normal subjects at US evaluation of the corpora cavernosa, corpus spongiosum and bladder neck and at elastography of the corpus spongiosum.

10:30 - 12:00 **Room P**

Contrast Media

SS 1306

Safety issues

Moderators:
G. Heinz-Peer; St. Pölten/AT
Y.W. Nielsen; Copenhagen/DK

B-0751 10:30

Prediction of chronic kidney disease as described in contrast-induced nephropathy prevention guidelines after contrast enhanced computed tomography: a cohort of 1000 patients

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Purpose: Assessment of accuracy of predicting chronic kidney disease (CKD) in patients undergoing CECT.
Methods and Materials: Risk factors mentioned in CIN prevention guidelines were assessed: diabetes mellitus (DM), history of urologic/nephrologic disease, nephrotoxic medication, cardiovascular disease, congestive heart failure, hypertension, anaemia, malignancy and kidney function (estimated glomerular filtration rate (eGFR)). Association between combinations of risk factors and CKD (eGFR < 60 ml/min or < 45 ml/min) were studied by Chi^2 test. False-positives (FP) and false-negatives (FN) were presented. We studied a combination of: 1) all risk factors, 2) DM, history of urologic/nephrologic disease, hypertension, age > 60 years; 3) DM, history of urologic/nephrologic disease, nephrotoxic medication.
Results: 998 patients, mean age 59.93±13.57 years.115 patients had eGFR < 60 ml/min and 31 < 45 ml/min. Combination 1 identified 816 patients: 108 with eGFR < 60 ml/min (FN 7/FP 708/Odds-ratio 3.814) and all with eGFR < 45 ml/min (FP 785). Combination 2 identified 745 patients: 108 with eGFR < 60 ml/min (FN 7/FP 637/Odds-ratio 5.956) and all with eGFR < 45 ml/min (FP 714)). Combination 3 identified 561 patients, 89 with eGFR < 60 ml/min (FN 26/FP 472/Odds-ratio 2.981) and all with eGFR < 45 ml/min (FP 530). Of the 26 FN patients with eGFR 45-60 ml/min, 6 had one risk factor (age > 75 years/anaemia). All associations between eGFR and combinations were significant (p-values < 0.01).
Conclusion: Because of the proportion of FP, a combination of all risk factors is not accurate in predicting CKD. A less elaborate model seems more accurate and might also be more cost-effective.

B-0753 10:39

CIN or just fluctuations?

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Purpose: To study fluctuations in estimated glomerular filtration rate (eGFR) in relation to contrast medium (CM)-enhanced magnetic resonance imaging (MRI) and computed tomography (CT) compared to control groups in outpatients.
Methods and Materials: eGFR was determined right before the imaging procedure and three days later at the department or at the patient's home. The iodine-based and gadolinium-based contrast media were the same as used for all other examinations at the department.
Results: A total of 716 patients completed the study. There was a statistically significant, but not clinically relevant rise in eGFR after three days in all four groups. The average eGFR variation was 4.8 ml/min/1.73m^2. There were large variations in eGFR between the two measurements in 41% of the patients as they had a change greater than ± 10 ml/min/1.73m2. Only three patients fulfilled the contrast-induced nephropathy (CIN) requirement when the definition s-creatinine ≥ 44 µmol/L was used.
Conclusion: eGFR in outpatients undergoing MRI or CT did vary independently of whether the patient received contrast or not. The findings probably reflect the natural variations in s-creatinine levels. This should be taken into consideration when CIN is studied. The problem of CIN seems to be overestimated.
Author Disclosures:
M. Azzouz: Equipment Support Recipient; Nova Biomedical sponsored the StatSensor Creatinine meter. **J. Roemsing:** Equipment Support Recipient; Nova Biomedical sponsored the StatSensor Creatinine meter. **H. Thomsen:** Equipment Support Recipient; Nova Biomedical sponsored the StatSensor Creatinine meter.

B-0754 10:48

Efficacy of questionnaire prior to contrast CT in predicting renal impairment for patients older than sixty years of age

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Purpose: Contrast-induced-nephropathy (CIN) is a preventable condition. Pre-CT questionnaire was routinely used only on patients less than 60 years-of-age to reduce the incidence of CIN. Patients over 60 years-of-age commonly require pre-CT renal function tests. The aim of this prospective study was to assess the efficacy of pre-CT questionnaire in patients over 60 years-of-age in predicting renal impairment.
Methods and Materials: All consecutive outpatients older than 60-years-of-age, who underwent contrast enhanced CT over 9 months period, were required to complete questionnaires containing 14 risk factors for CIN. Estimated-glomerulofiltration-rate (eGFR) and serum creatinine level were obtained and results were compared.
Results: A total of 922 patients were included (mean age: 71). 36.12% patients answered no risk factor. 37.2% patients had 1 risk factor and 26.68% had ≥2 risk factors. All groups had similar patient demographics and disease prevalence. 103 (11.17%) patients had eGFR< 60, including 1.63% patients with eGFR < 40. The questionnaire demonstrated an overall negative predictive value (NPV) of 96.7%. NPV was 97.6%, 97.5% and 91.7% for patients between 60-69, 70-79 and ≥80 years-of-age. NPV was 86.9% and 80.9% respectively when there were 1 and ≥2 risk factors. Relationship between number of risk factors and severity of renal impairment was weak (correlation coefficient r=0.2393, p-value 0.0149). Kidney disease and myeloma as risk factors had relatively higher correlation with renal impairment.
Conclusion: Negative pre-CT questionnaire is shown to be an effective screening tool for renal impairment in patients over 60 years-of-age, hence, reduces the need and cost of performing renal function tests.

B-0755 10:57

Can a structured questionnaire identify patients with reduced renal function?

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Purpose: To evaluate the value of a structured questionnaire in identifying outpatients with renal dysfunction before MRI or CT examinations.
Methods and Materials: All patients completed a questionnaire with five risk factors indicating renal dysfunction: renal disease, renal surgery, hypertension, gout and diabetes. S-creatinine determined by point of care (POC) technique and estimated glomerular filtration (eGFR) rate was calculated using CKD-EPI equation.
Results: A total of 1467 patients were enrolled. Thirty-four (2%) patients had an eGFR< 30 ml/min/1.73m^2 and 123 (8%) had an eGFR< 45 ml/min/1.73m^2. Among 55% patients reporting at least one risk factor, 30 (4%) had an eGFR< 30 ml/min/1.73m2 and 105 (13%) had an eGFR< 45 ml/min/1.73m^2.Among 651 patients not reporting a risk factor, 4 (0.6%) had an eGFR< 30 ml/min/1.73m^2 and 18 (3%) had an eGFR< 45 ml/min/1.73m^2. All 4 patients were > 70 years, and 12 of the 18 patients were > 70 years. Among 81 patients > 80 years, 33% had an eGFR< 45 ml/min/1.73m^2 and 16% of 368 patients were > 70 years.
Conclusion: The questionnaire used in patients < 70 years and determination of eGFR in patients > 70 years identified all patients with an eGFR between 30-45 ml/min/1.73m^2 except 0.4%.
Author Disclosures:
J. Roemsing: Equipment Support Recipient; Nova Biomedical sponsored the StatSensor Creatinine meter. **M. Azzouz:** Equipment Support Recipient; Nova Biomedical sponsored the Statsensor Creatinine meter. **H. Thomsen:** Equipment Support Recipient; Nova Biomedical sponsored the StatSensor Creatinine meter.

B-0756 11:06

Contrast induced nephropathy prevention guidelines: should we determine eGFR in all patients or in a selected group of patients based on risk profile?

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Purpose: To assess whether pre-selection by assessment of risk factors in patients before determining eGFR is more cost-effective compared to a strategy where eGFR is determined in all patients undergoing CECT.
Methods and Materials: Patients were interviewed to assess risk factors and costs. In our institute eGFR is evaluated in all patients, we considered a tenability of 12 months for eGFR, eGFR was available in all patients. For the pre-selection strategy we extrapolated data by assuming equal distribution of patient characteristics between both strategies.
Results: We included 1,001 patients, mean age 59.93 ± 13.57 years. Strategy with eGFR in all patients: the number of patients in which eGFR was determined before CECT was 645/1,001. In this population 49 patients paid an extra visit to the hospital, 11 patients had to take a leaf of absence from work for this visit. The total cost of this strategy was: 5766.05 euro. In the other 356 patients the eGFR was already known.Pre-selection strategy: 807/1,001 patients had risk factors, and eGFR determination was indicated. Based on the equal distribution, we assumed that 44 patients would have visited the hospital for eGFR determination, 10 would have taken a leaf of absence. Total cost, inclusive eGFR determination in 807 patients would be: 6565.44 euro. No patients with an eGFR < 45 ml/min or eGFR < 60 ml/min and diabetes mellitus or > 1 other risk factor would have been missed by this strategy.
Conclusion: Determination of eGFR in all patients seems cost-effective when tenability for eGFR is applied.

B-0757 11:15

NSsaFe study: observational study on the incidence of nephrogenic systemic fibrosis (NSF) in renal impaired patients following gadoteric acid administration

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Purpose: To prospectively estimate the incidence of NSF in patients with moderate to severe renal impairment after administration of gadoteric acid.
Methods and Materials: A worldwide post-marketing study being conducted to collect safety data in 1,000 patients (adults and children) with moderate to severe and end stage renal impairment, scheduled to undergo a routine contrast-enhanced magnetic resonance imaging using gadoteric acid (DOTAREM®). Risk factors at inclusion, indications for MRI and occurrence of adverse events are recorded for each patient. Three follow-up visits are performed between 3 and 27 months after MRI in order to detect any occurrence of NSF.
Results: As of August 29, 2013, the cut-off date for the interim safety analysis, the study included 309 patients (mean age: 69.6 years (range: 21-92); male, 63.1%). Mean eGFR at inclusion was 35.8 ml/min/1.73m^2 (range: 4.0-59.1) including 63.4% of moderate, 18.4% of severe, 14.9% of end stage renal insufficiency or dialysis and 3.2% of kidney transplanted patients. The first follow-up visit (between 3 and 12 months after MRI) was done for 128 patients, the second follow-up visit (between 13 and 21 months after MRI) was done for 42 patients. Only 2 patients (0.6%) had serious adverse events not related to gadoteric acid. No NSF occurred.
Conclusion: This interim safety analysis confirms the very good safety profile of gadoteric acid in renal impaired patients.

B-0758 11:24

Tolerability and diagnostic effectiveness of gadoteric acid (Gd-DOTA): use in daily routine and in patients with diminished kidney function

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Purpose: To investigate the tolerability and diagnostic effectiveness of Gd-DOTA (Dotarem®, Guerbet, Roissy, France) in routine clinical use and in patients with impaired kidney function.
Methods and Materials: Between January 2011 and July 2013, 32,286 patients (44.7% male, 55.3% female, mean age 52.0±17.0 years) underwent contrast-enhanced MRI (Gd-DOTA, mean volume 15.7 ml) in 43 German centers, including neurological examinations (48.7%), musculoskeletal examinations (30.7%) and examinations of the internal organs (13.2%). 26.8% of patients were at-risk patients including patients with allergies (16.7%) and a previous reaction to contrast media (0.4%). In 854 patients (2.6%), eGFR was < 90 ml per minute. Imaging quality (assessed on a 5-point scale: excellent/good/moderate/poor/very poor) and diagnostic effectiveness were assessed for each individual examination. Adverse reactions and serious adverse reactions were documented.
Results: Adverse reactions occurred in 110 out of 32,286 patients (0.3%), generally involving gastrointestinal disorders (0.2%) or skin and subcutaneous tissue disorders (0.1%). In 5 patients (0.015%), the adverse reactions were serious. All patients with adverse reactions recovered after the examination. No adverse reactions were observed in the 854 patients with an eGFR < 90 ml per minute. A diagnosis was possible in 99.9% of all examinations. Image quality was rated excellent or good in 98.5% of all examinations, moderate in 1.4% and poor in 0.1%.
Conclusion: In routine clinical use, Gd-DOTA has proved to be a safe contrast medium, including in patients with an eGFR < 90 ml per minute, which enables MRI examinations to be performed with high diagnostic effectiveness.
Author Disclosures:
M. Maurer: Consultant; Guerbet GmbH. **O. Heine:** Employee; Guerbet GmbH.

B-0759 11:33

SECURE study: observational post-marketing study on the safety of gadoteric acid

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Purpose: To prospectively assess the safety profile of gadoteric acid and the overall incidence of nephrogenic systemic fibrosis (NSF).
Methods and Materials: An ongoing worldwide post-marketing study (PMS) is conducted to collect safety data in 40,000 patients (adults and children) with or without renal insufficiency, scheduled to undergo a routine contrast-enhanced magnetic resonance (MR) imaging using gadoteric acid (Dotarem®). Risk factors at inclusion, indications for MR imaging, conditions of the contrast material administration and occurrence of adverse events are recorded. For any patient identified with renal impairment at the time of inclusion (i.e., estimated creatinine clearance or estimated glomerular filtration rate < 60 mL/min/1.73 m²), a follow-up is performed after at least 3 months in order to detect any suspicion or occurrence of NSF.
Results: The latest interim safety analysis of this ongoing PMS included data on 29,689 patients (mean age: 50 years; range: 0-98 years; female: 53.4%). MR examinations were mainly performed to image the central nervous system (55.1%). The main risk factors were renal insufficiency (12.7%) and hypertension (11.8%). Moderate to severe impaired renal function was reported in 552 patients (1.9%). Among them, 391 (70.8%) were reported without suspicion of NSF during the 3-month follow-up. For the remaining patients (29.2%), the follow-up evaluation was not yet reported at the time of data analysis. Twenty-eight patients (< 0.1%) had at least one adverse event (mainly nausea, urticaria, vomiting, fever and multiorgan failure syndrome).
Conclusion: This interim safety analysis already confirms the very good safety profile of gadoteric acid.
Author Disclosures:
M. Hackenbroch: Grant Recipient; Travel grant.

B-0760 11:42

Effect of contrast agent temperature on aortic enhancement profile in CT angiography: a phantom study

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Purpose: To analyse the effect of iodinated contrast agent temperature on aortic enhancement characteristics in CT-angiography.
Methods and Materials: A custom made physiologic flow-phantom was designed to simulate the cardiovascular system in a medium-sized patient. 70 ml of two contrast agents (agent A, iobitridol, Xenetix 300, Guerbet and agent B, iomeprol, Iomeron 400, Bracco) were administered at rates of 4 and 6 ml/s (CT-Motion, Ulrich Medical) at three different temperatures (22 °C, 30 °C, and 37 °C). At 37 °C, the viscosity of agent A and agent B are 6.0 mPa.s and 12.6 mPa.s. The phantom was scanned with 100 kVp and 200 mAs (Somatom Definition Flash, Siemens). Dynamic CT-images were acquired after contrast agent injection with 1 image per second for 50 seconds. Peak aortic enhancement (PAE) and the duration of aortic enhancement ≥ 200 HU were recorded.
Results: For agent A the PAE at 22 °C, 30 °C and 37 °C measured 237, 231, and 235 HU, at a flow rate of 4 ml/s, and 297, 320, and 321 HU at a rate of 6 ml/s, respectively. Corresponding PAE measurements for agent B were 308, 312, and 310 HU, at a flow rate of 4 ml/s, and 422, 418, and 424 HU at a flow rate of 6 ml/s, respectively. The duration of aortic enhancement ≥ 200 HU was dependent on iodine concentration (9 to 10s for agent A, and 12 to 14s for agent B), but independent of contrast media temperature.
Conclusion: CT contrast agent temperature does not impact the aortic enhancement profile in CT-angiography.
Author Disclosures:
J. Froehlich: Employee; Guerbet AG. **U. von Baer:** Employee; Ulrich Medical. **S. Schindera:** Equipment Support Recipient; Ulrich Medical.

Monday, March 10

10:30 - 12:00 **Room B**

Abdominal Viscera

SS 1701

Functional MR of the liver

Moderators:
B.I. Choi; Seoul/KR
H.J. Michaely; Mannheim/DE

B-0761 10:30

Non-invasive differentiation between simple steatosis and steatohepatitis using gadoxetic acid-enhanced MRI in patients with non-alcoholic fatty liver disease: a feasibility study

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Purpose: To determine whether gadoxetic acid-enhanced MRI can be used to distinguish between simple steatosis (SIS) and non-alcoholic steatohepatitis (NASH) in non-alcoholic fatty liver disease (NAFLD) patients defined according to the Steatosis Activity Scoring system (SAF).
Methods and Materials: This was a retrospective study of gadoxetic acid-enhanced 3-Tesla MRI performed on 81 consecutive patients with suspected NAFLD [45 (56%) males (mean age 56y, range: 25-78)]. Patients were classified as SIS or NASH using the SAF score based on the semiquatitative scoring of steatosis, activity and liver fibrosis. The MR images were analysed using the relative liver enhancement measured as the ratio of signal intensities of the liver parenchyma before and 20 minutes after intravenous administration of gadoxetic acid. Univariate and multivariate regression analyses were applied to identify variables associated with relative enhancement measurements, and the performance of relative enhancement values was assessed for the differentiation between SIS and NASH using the area under the receiver operating characteristic curve (AUC) analysis.
Results: Testing the relationship between enhancement measurements and histology, relative enhancement values correlated strongly with lobular inflammation ($r=-0.59$, $p=< 0.001$), ballooning ($r=-0.44$, $p=< 0.001$), and fibrosis ($r=-0.59$, $p=< 0.001$), but not with steatosis ($r=-0.15$, $p=0.15$). In multivariate analysis, all three histological parameters were independently associated with the relative enhancement. The measurements performed well for the differentiation between SIS and NASH, with an AUC of 0.85, [cutoff=1.24, (Sesitivity=97.1%, Specificity =63%)].
Conclusion: Gadoxetic acid-enhanced MRI may be used as a non-invasive diagnostic tool to distinguish between SIS and NASH in NAFLD patients.

B-0762 10:39

MRI-proton spectroscopy in diognosis of NADFL

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Purpose: Purpose of our study is to determine the possibilities of MRS for the diagnosis of fatty liver and monitoring the effectiveness of treatment.
Methods and Materials: We investigated 85 patients (44 men, 41 women), mean age was 48 ± 11 years. The studied group consisted of two sub-groups: healthy volunteers (15 men) and patients with non-alcoholic fatty liver disease, diagnosed according to clinical examination (60 patients). In the group of patients MRS was performed twice: before treatment and six months after it began. The study was conducted on MRI scanner with magnetic field strength of 3 T, using a 32-channel coil. According these images the navigation of spectroscopic voxel (single voxel MRS, voxel size 20x20x20 mm) was done in the fifth segment of the liver. We used the protocol: TE - 50 ms, TR - 2000 ms, the spectral range - 2000, Samples - 1024. Calculation was done for each patient according to the formula of lipid concentration.s. (Lip) / S (H20) × 100.
Results: In the group of patients lipid concentration in 45 cases was measured and draws up to more than 10%. the diagnosis of NAFLD was eliminated. At the second examination (as a result of lipid-lowering therapy and diet) in 34 patients were detected reduction in the concentration of fat to normal values.
Conclusion: MRS could be used as an additional criterion for the diagnosis and assessment of treatment of NAFLD, especially in cases when carrying out liver biopsy is not possible.

B-0763 10:48

Association between central obesity and liver iron: a non-invasive assessment in general population by magnetic resonance imaging

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Purpose: Existing evidence suggests an altered iron metabolism in obesity. Published data evaluating association of hepatic iron with obesity are lacking. We aimed to investigate whether central obesity is independently associated with liver iron content in general population using non-invasive assessment by MRI.
Methods and Materials: The study was carried out on 202 subjects randomly selected from general population, aged 50-77 years, who underwent abdominal MRI (1.5 T) including multiechoT2*-weighted sequence of liver. Quantitative T2* maps of entire cross-sectional area of liver was calculated on a pixel-by-pixel basis using a semi-automated software to measure mean T2* of whole liver. Visceral and subcutaneous fat areas were measured by two examiners in axial T1-weighted images at the level of umbilicus.
Results: There was no significant difference in mean values of T2* between obese (BMI> 30 kg/m^2) and non-obese (BMI≤30 kg/m^2) subjects. After controlling for other covariates including age, BMI, ferritin, hemoglobin, FBS, HBA1c and steatosis no statistically significant association was detected between liver T2* values and visceral and subcutaneous fat areas in men and women. Likewise, the association between liver T2* values and ratio of visceral to subcutaneous fat was not demonstrated in multivariable analysis.
Conclusion: Central obesity indices are not correlated with estimated liver iron content in MRI. This study could not support the hypothesis of probable hepatic iron release due to obesity-related biomarkers. The relationship, if it exists, should be investigated in the future studies.

B-0764 10:57

The feasibility of texture analysis using susceptibility-weighted magnetic resonance imaging in detecting patients with liver cirrhosis

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Purpose: To establish the feasibility of textural features of liver parenchyma obtained on susceptibility weighted magnetic resonance imaging (SWI MRI) which will enable the detection of liver cirrhosis in patients with diffuse chronic liver diseases (CLD).
Methods and Materials: Sixty-five patients (mean age, 51.65 years; 60% males) with CLD and histologically proven liver fibrosis (evaluated according to the Metavir scoring) were included in a retrospective manner and grouped in patients with (F4 Metavir, n=27, 42%) and without (F0-F3 Metavir, n=38, 58%) liver cirrhosis. All patients underwent 2D multislice breath-hold SWI sequence on a 3 T MRI unit and the imagines were used for texture analysis. Texture features derived from the grey-level histogram, the co-occurrence matrix, the run-length matrix, the absolute gradient, the autoregressive model, and the wavelet transform were calculated for the ROIs. Fisher coefficients were calculated to determine which texture features were best suited for distinguishing between no-cirrhosis and cirrhotic liver tissue. Based on the ten best-suited texture features, linear discriminant analysis was performed, and a k-nearest neighbor (k-NN) algorithm was used for disease classification. The classification accuracy, sensitivity and specificity were used as primary and secondary outcome measures.
Results: Six out of ten texture features selected on the basis of Fisher coefficients were derived from grey-level histogram. Of the 65 patients included, 62 (95.38%) were classified correctly by k-NN. Sensitivity was 96.3% and specificity was 94.7%.
Conclusion: Texture features extracted from the grey-level histogram are feasible to correctly identify cirrhotic changes in liver parenchyma of patients with CLD.

B-0765 11:06

Unenhanced MRI of the liver: morphology assessment on diffusion-weighted images has additional diagnostic value to quantitative apparent diffusion coefficient (ADC) measurements

P.A.T. Baltzer[1], M. Dietzel[2], W.A. Kaiser[3]; [1]*Vienna/AT*, [2]*Erlangen/DE*, [3]*Jena/DE*

Purpose: Diffusion-weighted imaging (DWI) is regularly applied as an additional contrast for detection and characterisation of focal liver lesions (FLL) in MRI of the liver. Besides quantitative information by means of apparent diffusion coefficient (ADC) measurements, DWI images do also provide morphological information. We investigated whether diagnostic accuracy for differentiation of FLL could be improved by adding visual interpretation of DWI images to quantitative ADC measurements.
Methods and Materials: Consecutive patients with suspected liver metastases without prior treatment were examined using breathhold EPI-DWI (TR/TE: 2100/62 ms, 2 b values). A blinded radiologist (> 8years MRI experience) assessed morphological criteria such as lesion border (smooth vs irregular) and internal structure (homogeneous vs heterogeneous) on DWI images. Additionally, ADC values were measured by means of regions of interest. The radiologist assigned a diagnostic rating on a 5-point confidence scale (1: definitive benign to 5: definitive malignant). Diagnostic accuracy of ADC and qualitative assessment were compared by means of ROC analysis.
Results: Eighty-nine FLL were detected using DWI (50 malignant and 39 benign). Diagnostic accuracy of ADC-values was significantly lower (0.895, 95% CI 0.812-0.950) as compared to additive assessment of morphological criteria on DWI images (0.941, 95% CI 0.870-0.980; $P < 0.05$)

Conclusion: In unenhanced MRI of the liver, diagnostic accuracy of DWI interpretation could be improved compared to quantitative ADC measurements by integration of morphological criteria on DWI images as interpreted by an experienced radiologist.

B-0766 11:15

Steatosis quantification: comparison MRI vs histology in rat model using total intrahepatic triglycerides as reference

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Purpose: To evaluate the steatosis quantification by MRI in a murine model and compare it to histological quantifications using semi quantitative visual analysis or automated surface analysis.
Methods and Materials: Eleven groups of two rats undergo a choline methionine deficient diet. An 1.5 T MRI was carried out at day 0, 2, 4, 5, 6, 7, 8 and week 2, 3, 4, 5. Using a phased-array surface coil, an EG T1 in and out phase multi echo sequence, without cardiac or respiratory synchronisation, was performed. Steatosis was calculated with the 3 echo method. Histological quantifications were performed both by visual evaluation of the percentage of fatty hepatocytes and by an automated measurement of the steatosis area (AOS). The reference was the total intrahepatic triglycerides (TIT) concentration.
Results: A steatosis without inflammation was obtained with an amount proportional to the duration of the diet. Correlations with TIT were better for MRI than for AOS and for histological quantification (RSpearman respectively r=0.897 r=0.889, r=0.753 $p < 0.0001$). Analysis of intra-class correlation coefficient was better for MRI than for AOS which tends to overestimate the steatosis (ICCC=0.889 versus ICCC=0.629). For visual histological quantification ICCC was low (0.280). In multivariate analysis, only MRI was identified as independent predictor of liver TIT.
Conclusion: MRI is reliable, easy, fast and superior to histological techniques for the assessment of hepatic steatosis in a murine model.

B-0767 11:24

The effect of echo times on the accuracy of susceptibility weighted magnetic resonance imaging in staging liver fibrosis

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Purpose: To assess the effect of echo-sampling on the accuracy of magnetic resonance (MR) susceptibility-weighted imaging (SWI) to detect and stage liver fibrosis in patients with chronic liver diseases (CLD), using histology as reference.
Methods and Materials: Sixty-eight patients were included. SWI was performed with two different echo times (TE), 2.5 ms and 10 ms. Signal intensity (SI) of the liver and spinal muscle was measured and liver-to-muscle signal intensity ratios were calculated. Diagnostic performance of both LMR in staging liver fibrosis was assessed using sensitivity (Se%), specificity (Sp%) and area under receiver operating characteristics (AUROC) analysis.
Results: Histology resulted F0 (n=13), F1 (n=6), F2 (n=8), F3 (n=12), F4 (n=28). Both 2.5TE LMR and 10TE LMR correlated strongly with liver fibrosis (r=-0.74, $p < 0.0001$ and r=-0.84, $p < 0.0001$, respectively). Diagnostic performance of LMR at 2.5 TE was very good, with an AUROC of 0.85 (Se=90.7%, Sp=76.9%) for stages ≥F1, 0.88 (Se=95.8%, Sp=73.7%) for stages ≥F2, 0.90 (Se=92.5%, Sp=74.1%) for stages ≥F3 and 0.89 (Se=85.7%, Sp=82.1%) for liver cirrhosis diagnosis (F4). Diagnostic accuracy improved when the TE was increased to 10 ms, reaching an AUROC of 0.96 (Se=96.3%, Sp=100%) for stages ≥F1, 0.95 (Se=100%, Sp=78.9%) for stages ≥F2, 0.94 (Se=85%, Sp=92.6%) for stages ≥F3 and 0.92 (Se=92.9%, Sp=76.9%) for F4 diagnosis. MecNemar tests revealed a statistically significant difference between the two parameters regarding the diagnosis of early fibrosis (stages ≥F1, $p < 0.0001$).
Conclusion: SWI is a promising non-invasive tool to detect and stage liver fibrosis in CLD patients, having increased accuracy with higher TE values.

B-0768 11:33

DWI of liver lesions: IVIM model with different combination of 11 b values

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Purpose: Purpose of this study was to investigate diffusion coefficients evaluated with intravoxel incoherent motion (IVIM) model in liver lesions, in their different parameters: apparent diffusion coefficient (ADC), perfusion fraction (f), diffusion and pseudodiffusion coefficient (D and D*). Moreover, we tried to calculate the optimal b values to be utilised in their analysis.
Methods and Materials: Retrospective study of 96 patients undergoing MR with DWI between June 2011 and September 2012 with diagnosis of HCC (n=28), colorectal carcinoma metastasis (CCM) (n=24) or FNH (n=44). MR examinations were performed on a 1.5-T scanner (Siemens_Avanto) and DWI sequence was EPI (TR/TE=4361/54 ms) with 11 b-values. Using MatLab, the estimations of D, D* e f were carried out for different combination of b-values:C1,C2,C3. Statistics Analysis: scatter plot; 2 sample t test; Kruskal-Wallis test.
Results: ADC and D values were not significantly different between lesions. D* and f were not significantly different between HCC (160x10-3 mm2/sec; 22% respectively) and FNH (114x10-3 mm2/sec; 18%), whereas were significantly higher than in CCM (81x10-3 mm2/sec;8%) ($p < 0.05$). With lesser b values (C2,C3) D* shows a significant ($p < 0.05$) decrease in HCC (88x10-3 mm2/sec) while does not show significantly decrease in FNH and in CCM, thus loosing the difference between the above groups. f does not show a significantly decrease in the above groups,thus maintaining the statistical difference. D does not change. f in background liver parenchyma were not significantly different between HCC (21%), FNH (22%) and CCM (20%).
Conclusion: IVIM data are dependent of b values being utilised. The D* and f values are useful for the characterisation of hyper (HCC; FNH) and hypovascular lesions (CCM). A standardisation of techniques is necessary in order to compare results between different studies.

B-0769 11:42

Accuracy of ultrasound in the assessment of liver fat: an MRI correlation study

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Purpose: To investigate the accuracy of ultrasound in the assessment of liver fat using chemical shift encoded confounder corrected magnetic resonance imaging (MRI) as standard of reference.
Methods and Materials: In the context of a population-based screening, 1122 volunteers, 558 women, 564 men with a mean age of 53.0±13.7 years, underwent liver MRI (1.5 T, Avanto; Siemens Healthcare) and ultrasound (Vivid I; GE-Healthcare; 3.6Mhz transducer). Liver ultrasound was performed by certified observers evaluating the presence of liver steatosis subjectively. In addition, percentage of liver fat content was assessed using a R2*-,T1-,multi-peak fat-corrected chemical shift MRI. Sensitivity, specificity and area under the curve (AUC) were calculated for ultrasound compared to MRI as reference for all subjects and for subjects with ranges of the liver fat content separately.
Results: With MRI frequency of liver steatosis was 39.5%(443 subjects) in the general population: 304 (69%) subjects with mild, 121 (27%) and 18 (4%) subjects with moderate and high liver fat content, respectively. In contrast, with ultrasound frequency of liver steatosis was lower 32% (359 subjects). All over sensitivity, specificity and AUC for the assessment of liver steatosis by ultrasound were 0.65, 0.90, and 0.77, respectively. While the specificity of ultrasound was not affected by liver fat content (mild, moderate, high fat content: 0.89, 0.89, 0.90) the sensitivity (0.54, 0.88, 0.94) and AUC (0.71, 0.89, 0.92) increased with the amount of liver fat.
Conclusion: Ultrasound is a moderate approach to assess liver fat. The weakness of ultrasound in the assessment of liver fat, especially in subjects with mild steatosis should be considered.

B-0770 11:51

Assessing liver function by liver enhancement during the hepatobiliary phase with Gd-EOB-DTPA-enhanced MRI at 3 Tesla

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Purpose: The purpose of this study was to evaluate the usefulness of Gd-EOB-DTPA-enhanced 3 T MRI to determine the hepatic functional reserve expressed by the MELD score.
Methods and Materials: 150 consecutive patients underwent contrast-enhanced MRI with liver specific contrast media at 3 T. Patients were subdivided into two groups: 121 patients with a MELD score lower than or equal to 10 (normal liver function, NLF) and 29 patients with a MELD Score higher than 10 (impaired liver function, ILF). T1-weighted volume interpolated breathhold examination (VIBE) sequences with fat suppression were acquired before and 20 minutes after contrast injection. Relative enhancement (RE) between plain signal intensity and contrast-enhanced signal intensity was calculated and was used to determine and compare Gd-EOB-DTPA uptake into the liver parenchyma for patients with different MELD scores.
Results: RE differed significantly ($p \leq 0.001$) between patients with normal liver function (NLF, MELD score ≤ 10) (87.20% ± 29.50%) and patients with impaired liver function (ILF, MELD score > 10) (45.44% ± 26.52%). Cut-off values regarding the RE to differentiate NLF from ILF was 47.7% (AUC: 0.87). This cut-off value showed a sensitivity of 82.8% and a specificity of 92.7% regarding the differentiation of the analysed groups.
Conclusion: Gd-EOB-DTPA uptake into hepatocytes is strongly affected by liver function. In conclusion, Gd-EOB-DTPA-enhanced MRI and assessment of relative enhancement during the HBP may serve as a useful image-based test in liver imaging for determining regional and global liver function.

10:30 - 12:00 **Room C**

Cardiac

SS 1703

Coronary artery imaging with CT

Moderators:
L. Natale; Rome/IT
F. Wolf; Vienna/AT

B-0771 10:30

Effect of reduced x-ray tube voltage, low iodine concentration contrast medium and iterative reconstruction on image quality and radiation dose at coronary CT angiography: results of the prospective multicentre REALISE trial

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Purpose: To assess the effect of reduced x-ray tube voltage, low iodine concentration contrast medium and iterative reconstruction on image quality and radiation dose at coronary CT angiography (CCTA).
Methods and Materials: 231 consecutive patients with suspected coronary artery disease were prospectively randomised to one of two dual-source CCTA protocols: 120-kVp, 370 mgI/mL iopromide or iopamidol, and filtered back projection (n=116; 44 women; 55.3±9.8 years); or 100-kVp, 270-mgI/mL iodixanol, and iterative reconstruction (n=115; 48 women; 54.2±10.4 years). Attenuation in the ascending aorta and coronary arteries along with image noise was measured. Signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) were calculated. Image quality was scored on a five-point scale for each coronary segment. Size-specific dose estimates and effective doses were calculated. Data were compared using Student's *t* test and χ^2 test.
Results: There were no statistically significant differences in mean arterial attenuation (406.6±76.7 vs. 410.6±67.0 HU, p=0.673), image noise (18.7±3.8 vs. 17.9±3.4 HU; p=0.141), SNR (22.5±5.4 vs. 23.7±6.1; p=0.108), CNR (37.1±14.7 vs. 38.1±15.2; p=0.609) or image quality scores (4.1±0.9 vs. 4.0±0.9; p=0.179) between the 120 and 100-kVp protocols. Mean iodine dose was 26.5% lower (18.3±0.5 vs. 24.9±0.9 g; $p < 0.0001$) and mean effective dose was 34.9% lower (2.3±1.0 vs. 3.5 ±1.1 mSv; $p < 0.0001$) with the 100 kVp compared with the 120-kVp protocol.
Conclusion: Using low x-ray tube voltage and iterative reconstruction allows for decreasing the iodine load and effective radiation dose at CCTA while maintaining image quality.
Author Disclosures:
U.J. Schoepf: Consultant; UJS is a consultant for and / or receives research support from Bayer, Bracco, GE, Medrad and Siemens. Grant Recipient; GE Healthcare provided grant support and supplied contrast material for this study.

B-0772 10:39

Influence of iodinated contrast agents on heart rate variability during CT angiography of the coronary arteries: a prospectively randomised study

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Purpose: To assess the influence of different contrast agents on heart rate variability during CTA of the heart.
Methods and Materials: 207 patients (95 women) referred for cardiac CTA to rule out CAD and at a baseline heart rate below 70 were consecutively enrolled. CTA was performed after randomisation either during administration of Iodixanol (n=101) or Iomeprol. Patients were divided into three groups according to their body weight. In all patients within same body weight group same iodine delivery rate was used. Heart rates were recorded with a mobile heart rate monitor before, while and after contrast media administration. Contrast enhancement was evaluated at four predefined anatomical regions.
Results: While both contrast agents raise mean heart rates within 60 seconds after injection, iomeprol elevates heart rates earlier and to higher levels with a peak heart rate change of 13 bpm (iodixanol 7 bpm). 33 seconds after start of contrast administration iomeprol was found to induce significantly higher heart rate increases when compared to iodixanol. In the group of patients with body weight between 50 and 100 kg (n=177), differences in heart rates became significant within 18 seconds after start of contrast injection. There was no difference in arterial contrast enhancement between the two agents.
Conclusion: Iodixanol showed less influence on heart rate during cardiac CTA when compared to Iomeprol. The difference of heart rate increase between the two agents becomes significant after 18 seconds in most of the patients (and after 33 seconds in all patients).

B-0773 10:48

Hemodynamic significance of coronary stenosis by vessel attenuation measurement on CT compared with adenosine perfusion MRI

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Purpose: Corrected contrast opacification (CCO) calculation is a new technique based on coronary computed tomography angiography (cCTA) data, estimating the effect of stenosis on coronary flow. We assessed the association between CCO and inducible ischemia by adenosine perfusion magnetic resonance imaging (APMRI).
Methods and Materials: Sixty cardiac asymptomatic patients with extra-cardiac arterial disease (mean age 64.4±7.7 years;78% male) underwent cCTA and APMRI. Luminal CT attenuation values (Hounsfield Units) were measured in coronary arteries from proximal to distal. Additional measurements were performed in arteries with significant, > 50% lumen stenosis. CCO was calculated by dividing coronary CT attenuation by descending aorta CT attenuation at equal level. Decreases in CCO across the coronary artery and across stenosis were calculated, and compared with presence of inducible ischemia on APMRI using regression analysis.
Results: In total, 169 coronary stenoses were found. Seven patients had 8 perfusion defects on APMRI, with 11 stenoses in the corresponding coronary arteries. Baseline characteristics did not differ between patients with and without perfusion defect. Median CCO for normal coronary arteries was 1.075 [25th,75th percentile:0.978.1.169] at the origin, and 1.021 [0.876.1.142] at the distal segment. Difference in CCO across stenosis was significantly larger in patients with perfusion defect than in those without (0.144±0.112 vs.0.047±0.104,respectively;P=0.003). No difference was found between patients with anatomically significant stenosis and those without (0.054±0.116 vs.0.052±0.101;P=0.89).
Conclusion: Decrease in CCO across coronary stenosis is associated with myocardial ischemia on APMRI. CCO is a novel method to assess the hemodynamic significance of a stenosis, based on common cCTA data.

B-0774 10:57

CT coronary angiography: effect of iodine concentration on vascular attenuation: the CT-CON multicentric study preliminary results

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Purpose: To explore the relative impacts of iodine concentration versus iodine delivery rate on intracoronary attenuation. To describe the effect of iodine concentration on contrast bolus characteristics.
Methods and Materials: 675 patients were prospectively randomised in 4 groups and underwent CT coronary angiography (CTCA). Four CM with different iodine concentrations (300, 350, 370 and 400 mgI/ml) were delivered at a fixed iodine delivery rate (2.0 mgI/s). Intracoronary attenuation values were measured and grouped on a per-vessel and per-segment bases. Time-to-peak and pressure curves during CM injection were evaluated and compared.
Results: Injection fluxes were 6.7 ml/sec, 5.7 ml/sec, 5.4 ml/sec and 5 ml/sec for group A, B, C and D, respectively. No significant differences were observed among four groups in terms of intravascular density on a per-segment and per-vessels analysis. Time-to-peak was significantly earlier in group A (15.3 sec) than in the other three groups. The injection peak pressure was significantly lower in group A (185.16 psi) and C (189.05 psi) than in group B (215.89 psi) and D (243.33 psi). No extravasations were noted in all groups.
Conclusion: Contrast media with different iodine concentrations, if injected at the same IDR, provide similar intravascular attenuation values. The lower concentration contrast medium provided significantly lower injection pressure values and a significantly shorter time to peak enhancement.

B-0775 11:06

Collateral classification by computed tomography in patients with coronary total occlusion and its relation with downstream myocardial infarction

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Purpose: To study the hypothesis that the filling pattern of distal collaterals observed at coronary computed tomography angiography (CCTA) in patients with chronic total occlusion (CTO) may correlate to the extent of myocardial infarction (MI), with reference to cardiac magnetic resonance (CMR) imaging.
Methods and Materials: All patients gave written informed consent and the institutional review board committee approved the study protocol. 97 patients (mean age: 68.5±11.5, range 38 to 87 years, 77 males and 20 females) with 106 coronary total occlusions were prospectively enrolled in this study. Distal collaterals were classified into three types according to their filling patterns using Rentrop classification. Rentrop grade 3 was considered as well-developed collaterals and Rentrop grade 0-2 were considered as poorly

developed collaterals. Downstream myocardial infarction and wall motion abnormality was verified by CMR semi-quantitatively. Mann-Whitney U test was used for comparison.
Results: The overall diagnostic accuracy of CCTA classification of distal collaterals was 86.8% (92/106), with correlation to invasive coronary angiography (ICA). Highest collateral grading was associated with non-MI subgroup whereas lowest grading was associated with transmural-MI subgroup (2.7±0.6 versus 1.8±1, p=0.005). Compared to poorly developed collaterals group, well-developed collaterals group (Rentrop grade 3) correlated to lower summed transmurality score (1.4±2.5 versus 3±2.6, $p < 0.001$) and lower summed regional wall motion abnormality score (0.5±1.7 versus 1.1±2, p=0.029).
Conclusion: The presence of well-developed distal collaterals as revealed by CCTA in patients with CTO lesions correlates to the lower frequency and extent of downstream MI.

B-0776 11:15

The impact of combining low-tube voltage scanning with iterative reconstruction on total iodine dose in coronary CT angiography
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Purpose: To assess the impact of combining low-tube voltages and iterative reconstruction (IR) on contrast dose in coronary CTA.
Methods and Materials: A standard of care (SoC) 120 kVp scan with 320 mgI/ml iodine-based contrast (Visipaque, GE Healthcare) and FBP reconstruction was compared with two study protocols: 80 kVp with 160 mgI/ml (protocol A) and 100 kVp with 200 mgI/ml (protocol B), both reconstructed with IR (ASiR). Each protocol was scanned (Discovery) three times on two minipigs (Ellegaard) with constant injection protocol (speed 3 ml/s, volume 1.5 ml/kg) and radiation dose. Quantitative image quality was evaluated by CT-value and signal-to-noise ratio (SNR) of the right coronary artery (RCA), left anterior descending coronary (LAD) and left circumflex artery (LCx). Expert readers performed qualitative assessment for overall quality, vessel sharpness, noise and streak artefacts.
Results: Despite reduced iodine load, both study protocols did not yield inferior CT-value and SNR for all arteries. For RCA, the mean SoC signal (307 HU) was preserved with protocol A (273 HU, p=0.15) and B (258 HU, p=0.08). Also the SNR was non-inferior from SoC (SNR=7.0) with A (8.1, p=0.75) and B (8.7, p=0.57). All scans were perceived to be of at least acceptable quality on all evaluated parameters allowing diagnostic interpretation. No statistical differences were observed (all p-values> 0.12), except for streak artefacts (p=0.01) who were considered to be more severe, although acceptable, with protocol A.
Conclusion: The use of a reduced tube voltage combined with iterative reconstruction allows a marked reduction in iodine dose up to a factor of two without impairing image quality.
Author Disclosures:
N. Buls: Advisory Board; GE Healthcare. **K. Nieboer:** Advisory Board; GE Healthcare. **J. De Mey:** Advisory Board; GE Healthcare. Research/Grant Support; GE Healthcare.

B-0777 11:24

Modified Morise score in predicting obstructive coronary artery disease prevalence at 64-row coronary CT angiography
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Purpose: To evaluate modified-Morise score (MMS) including contrast medium arrival time (AT) in conventional Morise score to predict obstructive coronary artery disease (CAD) prevalence in coronary CT angiography.
Methods and Materials: Consecutive 665 patients who underwent coronary CT angiography were restrospectively included. AT was determined as the time from the start of the injection to the threshold of 100 HU at the descending aorta during the bolus-tracking scan. Morise pre-test score was calculated for each patient. AT-heart-rate product (AHP) and MMS was defined as AT*heart rate/100 and AHP*Morise score/10, respectively. Obstructive CAD was determined as stenosis ≥50% at coronary CT angiography.
Results: A total of 441 patients (66%) showed no obstructive CAD. AT, AHP and MMS were larger in patients with obstructive CAD compared with patients without (19.1 vs 18.7; p = 0.06, 11.8 vs 11.3; p = 0.0014, 15.7 vs 13.7; $p < 0.0001$). Receiver operating characteristics analysis showed that MMS significantly improved the area under the curve compared with Morise score alone in predicting obstructive CAD (0.63 vs 0.59; p = 0.01). The prevalence of obstructive CAD was significantly higher in the second to fourth quartiles compared with the first quartile of MMS (odds ratio (OR): 2.21, 95% confidence interval (CI): 1.34-3.71; OR: 2.66, 95%CI: 1.63-4.41 and OR: 3.72, 95%CI: 2.28-6.18, respectively).
Conclusion: Larger MMS was associated with higher prevalence of obstructive CAD. MMS had an additive value over the Morise model alone to predict obstructive CAD in coronary CT angiography.

B-0778 11:33

The cost-effectiveness of cardiac CTA for the detection of significant coronary artery disease in patients undergoing pre-operative liver transplantation evaluation
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Purpose: Screening for significant coronary artery disease (CAD) in pre-liver transplantation candidates with end-stage liver disease is controversial due to concerns about screening test (ST) accuracy and cost-effectiveness (CE). This economic evaluation modeling study was performed to determine the CE of coronary CT angiography (CTA), dobutamine stress echo, SPECT imaging, and invasive cardiac CATH compared to a no screening test strategy (NST).
Methods and Materials: A retrospective review of 242 consecutive transplant candidates was conducted to define model inputs for decision analysis. Perspective: large tertiary academic university hospital in the Midwest USA. Other sources: extant literature, systematic reviews, meta-analysis, hospital accounting and clinical testing laboratory certification data, and expert panel input utilising a modified Delphi exercise. Outcome measure: net monetary benefit (NMB), willingness-to-pay (WTP) criteria and incremental health care cost and quality adjusted life years (QALYs) gained, one-way and probabilistic sensitivity analysis.
Results: CTA is the optimal ST strategy with an incremental effect of 1.16 QALYs gained at an incremental cost of $31,632 equivalent to $27,222 per QALY gained (ICER) when compared to the undominated NST. CTA resulted in a NMB of $36,186 assuming a WTP of $50,000, at a cost per QALY of $42,248 and demonstrated extended dominance over the alternative screening test strategies. According to sensitivity analysis the results are dependent only upon the prevalence of CAD and were insensitive to screening test and interventional costs.
Conclusion: When compared to a NST, CTA may be more cost-effective than other imaging modalities in the evaluation of liver transplant candidates.

B-0779 11:42

Dose optimisation in coronary CT angiography: is it restricted to the prospective ECG gating mode? Results from a multicentre study
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Purpose: To compare patient dose in coronary Computed Tomography Angiography (cCTA) using different dose reduction techniques and different CT scanners.
Methods and Materials: Volume Computed Tomography Dose Index (CTDIvol) was retrospectively collected from 387 cCTA performed in 7 centres, within both academic and non-academic hospitals specialised in cardiac imaging, using 64-, 128- or 320-detector CT scanners. About 50 examinations were collected in each centre over a 3 months period, using the routine local protocols, taking differently into account the Body Mass Index (BMI). Prospective ECG-gating was used in 4 centres and iterative reconstruction (IR) in 5 centres. Image quality was considered satisfactory in each centre and has not been evaluated in this study. Data were analysed by the French National Institute for Radiation Protection (IRSN).
Results: Mean CTDIvol per centre varied by a factor of 4.5 (range of means±SD: 14±6 to 63±9 mGy). Minimum and maximum values were collected on CT scanners using IR. The dispersion of the mean CTDIvol was more important using retrospective compared to prospective gating (21±10 to 63±9 mGy and 14±6 to 31±15 mGy respectively).
Conclusion: Prospective ECG gating and IR are efficient dose reduction techniques in cCTA but they do not exempt the centres from a more global optimisation approach. Whatever the brand and the generation of CT scanner, a significant dose optimisation is possible, using simple methods such as tube current and voltage adaptation to the BMI.

B-0780 11:51

Comparison of three iodine concentrations in the visualisation of coronary arteries by CT: a randomised European multicenter trial
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Purpose: To assess the diagnostic efficacy of iobitridol (Xenetix® 350) compared to iopromide (Ultravist® 370) and iomeprol (Iomeron® 400) in the visualisation of coronary arteries.
Methods and Materials: Randomised, double blind, non-inferiority phase IV trial including 468 patients with suspected coronary artery disease (CAD) who

were scheduled to undergo CT angiography. The primary endpoint was the CT scan evaluability for CAD diagnosis in terms of quality and interpretability of images. It was based on the full evaluation of 18 coronary segments for each patient and assessed by 2 off-site independent readers. Secondary endpoints were related to the safety and efficacy of the 3 contrast media (mainly image quality, stenosis assessment, and signal quantification).
Results: Out of the 452 patients completed for the primary analysis, 92.1% had their 18 segments fully evaluable in the iobitridol group, vs. 94.6 and 95.4% in the iomeprol and iopromide groups, respectively. Non-inferiority was statistically demonstrated between the 3 products, and no relevant differences between the 3 groups were observed for secondary endpoints. Eventually, the good general safety profile of products was confirmed.
Conclusion: This large trial shows that an optimal benefit/risk ratio is achieved as soon as an iodine concentration of 350 mgI/ml is administered for the visualisation of coronary arteries.
Author Disclosures:
M.H.K. Hoffmann and X-ACT Investigators: Advisory Board; NVT Technologies Hechingen Germany. Research/Grant Support; Guerbet. Speaker; Abbott Vascular Philips Medical Systems.

10:30 - 12:00 **Room D**

Chest

SS 1704
Challenges in oncologic imaging

Moderators:
F. Gleeson; Oxford/UK
M.O. Wielpütz; Heidelberg/DE

B-0781 10:30
Comparisons of capability for TNM and clinical stage assessment in non-small cell lung cancer patients among whole-body MRI, whole-body FDG-PET/CT and co-registered whole-body PET/MRI
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Purpose: To directly compare the capability for clinical stage assessment among whole-body MR imaging (MRI), integrated FDG-PET/CT and co-registered FDG-PET/MRI in non-small cell lung cancer (NSCLC) patients.
Methods and Materials: 70 consecutive pathologically diagnosed NSCLC patients prospectively underwent whole-body MRI at 3 T system, integrated FDG-PET/CT, conventional radiological examination, surgical treatment, pathological examination and more than 2-year follow-up examinations. Final diagnosis of TNM factors and clinical stage in each patient was determined according to all examination results. All co-registered FDG-PET/MRIs were generated by means of our proprietary software. Then, TNM factor and clinical stage on all methods were visually assessed by radiologists and nuclear medicine physicians. Then, final diagnosis in each patient was made by consensus of two readers on each method. To determine the agreements of TNM factor and clinical stage between each method and final diagnosis, kappa statistics were performed. To compare the diagnostic capability for operability assessment among all methods, sensitivities, specificities and accuracies were statistically compared each other by using McNemar's test.
Results: Each agreement with final diagnosis was as follows: T factor, $0.90 \leq \kappa \leq 0.93$; N factor, $0.60 \leq \kappa \leq 0.88$; M factor, $0.78 \leq \kappa \leq 0.93$; clinical stage, $0.55 \leq \kappa \leq 0.87$, respectively. When compared each operability assessment capability, sensitivity (100 < 51/51>) %) and accuracy (95.7 < 67/70>) %) of clinical stage assessment on MRI were significantly higher than those (sensitivity: 88.2 < 45/51>) %, $p < 0.05$; accuracy: 87.1 < 61/70>) %, $p < 0.05$) of PET/MRI and PET/CT.
Conclusion: Whole-body MRI is more accurate than co-registered FDG-PET/MRI and integrated FDG-PET/CT for clinical stage assessment in NSCLC patients.
Author Disclosures:
Y. Ohno: Research/Grant Support; Toshiba Medical Systems Corporation, Eizai Co. Ltd., Daiichi-Sankyo, Co. Ltd, Guerbet Japan. **M. Nishio:** Research/Grant Support; Toshiba Medical Systems Corporation. **T. Yoshikawa:** Research/Grant Support; Toshiba Medical Systems Corporation.s. **Matsumoto:** Research/Grant Support; Toshiba Medical Systems Corporation. **K. Aoyagi:** Employee; Toshiba Medical Systems Corporation. **H. Yamagata:** Employee; Toshiba Medical Systems Corporation.

B-0782 10:39
Evaluation of dual-input perfusion in lung cancer: using a 640-slice volume CT scan
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Purpose: The purpose of our study was to assess the dual blood input supply of lung cancer using a CT perfusion technique, and to analyse the correlations between dual perfusion and various characteristics of lung cancer.
Methods and Materials: Thirty-six consecutive patients with lung tumour that highly suggestive of malignancy were included in this study. All subjects underwent a dual-input dynamic perfusion volume scan using 320-raw-detector CT before CT-guided biopsy. Pulmonary trunk and descending thoracic aorta were selected for arterial input functions. From the computed CT data, pulmonary arterial perfusion (PP), aortic perfusion (AP) and perfusion index [PI, = PP/(PP+AP)] were calculated using the dual-input maximum-slope method. We statistically analysed the relationship of perfusion data with tumour locations (central, peripheral, and abutting the pleural locations), tumour volumes, pathologic type, and the presence of lymph node or distant metastasis.
Results: All subjects were pathologically diagnosed as primary malignant lung cancers by the CT-guided aspiration biopsy. The overall mean PI was $53.3 \pm 7.5\%$. The PI's showed significant difference by the tumour locations (central, 49.2 ± 3.3; peripheral, 55.5 ± 7.2; abutting the pleural, 48.9 ± 7.6, $P = 0.043$). In contrast, no significant difference was presented by tumour sizes ($r = -0.252$, $P = 0.139$) and by the presence of metastasis ($P > 0.05$).
Conclusion: We found the proportion of the dual perfusion in lung cancer is significantly dependent on tumour location, and this result may benefit of the management of lung cancer or prediction of prognosis.

B-0783 10:48
Discriminating between pneumonia and atelectasis on contrast-enhanced computed tomography: a quantitative approach
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Purpose: It is well known that atelectasis demonstrates greater enhancement than pneumonia on contrast-enhanced CT. However, radiologists underutilise this information because a quantitative threshold has never been determined discriminating between pneumonia and atelectasis. Our study establishes this threshold, which may allow for earlier diagnosis and treatment of pneumonia.
Methods and Materials: CT pulmonary angiogram (CTPA) exams containing consolidations were identified between 1/1/2012 and 7/31/2013. Consolidation was diagnosed as atelectasis (12 patients) or pneumonia (18 patients) based on multiple clinically accepted criteria. Hounsfield attenuation was measured in consolidated lung parenchyma (CL), ascending aorta (Ao), main pulmonary artery (MPA), and non-consolidated lung (NL). Mean enhancement values were compared of CL, Ao, MPA, NL in subjects with pneumonia and atelectasis. ROC analysis was performed to determine sensitivity and specificity of enhancement diagnosing pneumonia.
Results: The mean enhancement of atelectatic and pneumonia consolidations was 110.1 HU and 58.8 HU, respectively (p-value = 4.58E-07). There was no statistically significant difference in Ao, MPA and NL enhancement between pneumonia and atelectasis patients. The optimal threshold for discriminating regions of pneumonia from atelectasis in this sample was 70 HU (CI: 69, 97 HU). Using this threshold, where ≤70 would indicate pneumonia, the sensitivity and specificity for pneumonia was 93% (CI: 63, 99%) and 100% (CI: 88, 100%), respectively.
Conclusion: A threshold enhancement of 70 HU on a CTPA exam excludes pneumonia with a high degree of certainty. In combination with clinical history, a threshold of 70 HU enhancement allows for earlier and diagnosis treatment of pneumonia.
Author Disclosures:
G. Kicska: Grant Recipient; General Electric.

B-0784 10:57
Solitary fibrous tumours of the pleura: are there any scanographic features suggestive of malignancy? A 56-patient case series with anatomopathological correlation
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Purpose: To identify scanographic features predictive of anatomopathological malignancy, from a retrospective study of preoperative CT scans of resected solitary fibrous tumors (SFT) of the pleura.
Methods and Materials: CT scans of operated patients between December 2004 and November 2012 were analysed retrospectively. Scanographic features were studied without knowing anatomopathological diagnosis.
Results: The study population consisted of 56 patients (33 females and 23 males, mean age: 60 years old). SFT was asymptomatic, diagnosed incidentally in 22 cases (45.83%). Anatomopathological examination of

resection specimens (R0 resection in all cases) revealed that 23 tumors (41.07%) were histologically malignant. The significantly different criteria between malignant and benign types were: size (p=0.002) with a discriminatory threshold of 10 centimeters, tumor heterogeneity spontaneously (p=0.019) or after contrast medium injection (p=0.029), existence of intratumoral fluid density areas (p=0.011), a pleural effusion (p=0.010), measurable intratumoral vessels (p=0.019), a hypervascular character (intratumoral vessels and/or intense enhancement) (p=0.001). Intratumoral calcifications (p=0.200) and maximum post contrast density (p=0.58) were not significantly different.
Conclusion: CT features suggestive of anatomopathological malignancy of a SFT are: size greater than or equal to 10 centimeters, tumor heterogeneity, a hypervascular character of the tumor, presence of pleural effusion.

B-0785 11:06

The role of multi-sequence MR in the detection of pulmonary nodules
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Purpose: The purpose of this study was to assess the role of multi-sequence, multiplanar MRI in the detection of pulmonary nodules as compared to computed tomography (CT).
Methods and Materials: Thirty patients underwent both MRI and MSCT of the lungs (age range: 54-83 years, mean: 67.3). MRI (1.5 T) studies were performed in the following sequences: axial and coronal T2 TSE and T1 3D GRE and axial FatSat T2 TSE, T2 STIR, T2 HASTE and chemical shift imaging. Data was independently analysed by two blinded radiologists. MRI data was then compared to MSCT and verified to include a one-to-one correlation of nodule size and location. The general sensitivity, diameter-based sensitivity and MR sequence sensitivity was assessed in correlation to the detection rate of lung nodules.
Results: The overall sensitivity of MRI was 79.2%. MRI sensitivity according to nodules size was: 0% for nodules ≤3 mm, 77.8% for nodules between 3.1 mm and 7.9 mm, 100% for nodules between 8 mm and 19.9 mm and 100% for nodules between 20 mm and 30 mm. The positive predictive value (PPV) for the detection of pulmonary nodules was: 47% for nodules 3.1 - 7.9 mm, 81% for nodules 8 - 19.9 mm and 100% for nodules 20 - 30 mm.
Conclusion: MRI of the lungs does not allow for the detection of nodules ≤ 3 mm and shows moderate sensitivity for the detection of nodules between 3.1 and 7.9 mm. MRI yielded a 100% sensitivity for the detection of pulmonary nodules ≥8 mm.

B-0786 11:15

Steady-state free-precession sequence in differentiating lung cancer from adjacent atelectasis
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Purpose: Inoperable, advanced lung cancer is often accompanied with adjacent atelectasis. Differentiation between cancer and atelectasis is necessary to determine the field of radiation therapy or to evaluate the effect of therapy. Computed tomography (CT) is the gold standard, however, it is often difficult to distinguish cancer from atelectasis. Recently, diffusion-weighted imaging (DWI) has been reported as useful for this purpose, however, the image quality and anatomical information of DWI is insufficient. The aim of this study is to evaluate the steady-state free precession sequence (SSFP) for differentiating lung cancer from atelectasis.
Methods and Materials: Ten patients suspected of lung cancer with adjacent atelectasis on CT underwent magnetic resonance (MR) imaging. Using a 1.5-T scanner, DWI (b=0.1000 s/mm^2), T2-weighted images (T2WI) and SSFP were performed and apparent diffusion coefficient (ADC) and relative contrast of T2WI and SSFP were calculated for cancer and atelectasis. In addition, two independent observers evaluated the differentiating ability and the image quality using the 3-point scales. Statistical analyses were performed with paired t-test, Friedman test, Wilcoxon test, and analysis of variance.
Results: There was a significant difference between lung cancer and atelectasis on all evaluated imaging sequences. However, SSFP showed significantly high differentiating ability than T2WI and showed significantly better image quality than DWI and T2WI.
Conclusion: Advantages of the SSFP were a short acquisition time to avoid artefact and an inherent high contrast between lung cancer and atelectasis with detailed anatomical information, and SSFP could be considered as a useful modality.

B-0787 11:24

3D non-contrast-enhanced pulmonary perfusion MRI in non-small cell lung cancer patients: comparison of capability for postoperative lung function prediction with dynamic first-pass perfusion MRI, thin-section CT and Q scan
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Purpose: To directly the compare capability for postoperative lung function prediction among non-CE- and CE-perfusion MRIs, thin-section CT and Q scan in non-small cell lung cancer (NSCLC) patients.
Methods and Materials: Thirty-five NSCLC patients underwent thin-section MDCT, non-CE- and CE-perfusion MRIs, Q scan, surgical treatment and pre- and postoperative FEV_1% measurements. All non-CE-perfusion MRIs were acquired with an ECG-gated 3D half-Fourier fast SE sequence using a 3 T scanner. On non-CE- and CE-perfusion MRIs and Q scan, each regional perfusion rate in the resected lobe was determined as signal intensity or radioisotope uptake ratio between resected lobe and total lung. Then,each postoperative FEV_1% (poFEV_1%) was predicted from preoperative FEV_1% and regional perfusion rate in the resected lobe. poFEV_1%s of qualitative and quantitative CTs were predicted preoperative FEV_1% and total and resected lung segments and functional lung volumes determined by density-masked CT. To determine the capability of non-CE-perfusion MRI for regional perfusion assessment, regional perfusion rate of non-CE-perfusion MRI was statistically correlated with that of CE-perfusion MRI and Q scan. To determine the capability for prediction of postoperative lung function among all methods, each predicted poFEV1% was correlated with actual poFEV1%.
Results: Regional perfusion rate of non-CE-perfusion MRI had significant and excellent correlations with that of CE-perfusion MRI and Q scan ($r=0.70$, $p < 0.0001$). There were significant and excellent correlations between actual poFEV1% and each predicted poFEV1% ($r > 0.88$, $p < 0.0001$).
Conclusion: Non-CE-perfusion MRI has a potential for postoperative lung function prediction, and is considered as valuable as other methods in NSCLC patients.
Author Disclosures:
Y. Ohno: Research/Grant Support; Toshiba Medical Systems Corporation, Daiichi-Sankyo, Co. Ltd., Bayer Pharma.m. **Nishio:** Research/Grant Support; Toshiba Medical Systems Corporation. **T. Yoshikawa:** Research/Grant Support; Toshiba Medical Systems Corporation.s. **Matsumoto:** Research/Grant Support; Toshiba Medical Systems Corporation. **Y. Kasai:** Employee; Toshiba Medical Systems Corporation. **M. Yui:** Employee; Toshiba Medical Systems Corporation.

B-0788 11:33

Dynamic contrast-enhanced magnetic resonance imaging of lung lesions using a straightforward technique for morphological and quantitative kinetic analysis
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Purpose: To propose a straightforward technique for both morphological and quantitative kinetic perfusion analysis of lung lesions using dynamic contrast enhanced MRI.
Methods and Materials: 36 patients with 39 lung lesions (size range, 10-220 mm; 33 malignant) were prospectively scanned prior to therapeutic intervention. Fat-suppressed volumetric-interpolated T1W gradient-echo (VIBE) images were obtained during sequential short breath-holds after bolus triggered contrast injection. To obtain higher temporal resolution during the first passage of contrast, volume coverage of first 3 measurements was limited to include the lesion. Subsequent acquisitions were obtained with 1, 3 and 4 min. Two radiologists evaluated presence and morphology of enhancement separately and blinded. ROI-based signal intensity (SI)-time curves were created to evaluate the quantitative kinetic parameters.
Results: Readers agreed moderately in regard to enhancement morphology and substantially in regard to presence of significant enhancement inside the lesion. Different SI-time curve patterns and derived parameters (early peak of enhancement, slope of enhancement, maximum enhancement, washout ratio and relative enhancement at the 4th minute) were obtained for all lesions. An early peak > 15% showed 100% sensitivity to detect malignancy.
Conclusion: The proposed technique allows the analysis of nodules, masses and consolidations, permits the evaluation of enhancement morphology / progression together with the creation of SI-time curves, and acquirement of derived quantitative perfusion parameters. This strategy is simple and robust, based on visual and ROI-based analysis, and is therefore a step forward to bring lung MRI into the clinical scenario.

B-0789 11:42

Ground glass nodules evolution according with an history of tumour

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Purpose: To test the relation between oncologic anmnesis and CT pattern of growth in ground glass nodules (GGN).
Methods and Materials: 209 GGNs were diagnosed by CT in 147 subjects at our hospital. Demographic data and anamnesis were recorded. Subjects were categorized according to history of tumor as follows: "oncologic" and "non-oncologic". CT features of each GGN were assessed from an initial and a follow-up CT. GGNs of each category were then divided into "persisting" or "resolved". Pattern of growth in persisting GGNs was defined by an increase of total diameter or an appearance/increase of solid component diameter. Association of oncologic anamnesis with GGN growth was tested by Fisher's exact test and Kruskall-Wallis test.
Results: The 209 GGNs were found in 98/147 (66.7%) oncologic and 49/147 (33.3%) non-oncologic subjects. Pure GGNs (pGGN) were evenly represented in oncologic (91.9%) and non-oncologic (83.6%) subjects ($p = 0.09$). Disappearance rate was similar between non-oncologic (13.1%) and oncologic (20.27%) category ($p = 0.24$). Persisting GGNs showed similar growth rate between non-oncologic (30%) and oncologic (22.9%) subjects ($p = 0.34$). Growth pattern was associated with CT features of GGN, namely, diameter > 10 mm in pGGNs (HR = 15.43) and presence of solid component (HR = 23.08).
Conclusion: GGNs showed the same rate of growth pattern in either oncologic or non-oncologic subjects. Growth was related to CT features of GGN in all subjects, despite history of tumor. Therefore, CT management of GGN in oncologic patients should follow the same parameters used for non-oncologic subjects.

B-0790 11:51

Determining the lowest radiation dose parameters for virtual CT bronchoscopy: how low can we go?

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Purpose: To study the impact of radiation dose reduction strategies and reconstruction algorithms on conspicuity and size of endobronchial lesion by virtual CT bronchoscopy.
Methods and Materials: An anthropomorphic chest phantom containing a 1.2 cm bronchial polyp was scanned using 80, 100 and 120 kV and 10, 20, 40, 75 and 110 mA. Images were reconstructed with filtered back projection (FBP) and sinogram-affirmed iterative reconstruction (SAFIRE) algorithms. Randomised images were shown to two chest radiologists. Largest lesion diameter was measured in axial section. Volume-rendered images were evaluated for image quality and bronchial polyp conspicuity on a five-point scale. A score of 4 (corresponding to good image quality and lesion conspicuity) was considered acceptable for both. Paired *t*-test, Wilcoxon signed rank test and kappa statistics were used for analysis.
Results: The lowest radiation parameter at which both image quality and bronchial polyp conspicuity were given acceptable scores was 120 kV/10 mA (0.378mSv) for both FBP and SAFIRE. Image noise, CNR and SNR improved significantly for image sets reconstructed with SAFIRE when compared with FBP ($p < 0.0001$). Mean lesion diameter was comparable between the two reconstruction algorithms for effective doses above and below 1mSv ($p > 0.05$). The diameter measurements were similar for both radiologists below 1 mSv for each reconstruction algorithm ($p > 0.05$). Inter-observer agreement was good for lesion conspicuity ($k=0.73$).
Conclusion: Virtual CT bronchoscopy maintains good image quality and lesion conspicuity at significantly reduced effective dose, regardless of the reconstruction algorithm used. However, objective measures of image quality significantly improved with iterative reconstruction.
Author Disclosures:
A.R. Seyal: Research/Grant Support; Educational Grant support from Siemens Healthcare. **K. Parekh:** Research/Grant Support; Educational Grant support from Siemens Healthcare.

10:30 - 12:00 **Board Room B**

Paediatric

SS 1712

The child before and after surgery

Moderators:
F.E. Avni; Lille/FR
R. Llorens; Valencia/ES

B-0791 10:30

Doppler ultrasound for preoperative assessment of hepatic haemodynamics and prediction of early portal vein thrombosis after liver transplantation in paediatric patients with biliary atresia

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Purpose: To assess the preoperative hepatic hemodynamics in pediatric patients with BA (biliary atresia) at Doppler US and determine whether the ultrasonographic warning signs may predict early portal vein thrombosis (PVT) after liver transplantation (LT).
Methods and Materials: This retrospective study was approved by an institutional review board; informed consent was waived. 128 pediatric patients (66 male, 62 female, mean age, 11.73 months ±6.25 [standard deviation]) with BA younger than 3 years of age underwent Doppler US within 7 days before LT between October 2006 and June 2013. 7.03% experienced early PVT (within 1 month after LT). Receiver operating characteristic (ROC) analysis was performed to determine the optimal cutoff value for predicting early PVT.
Results: Of the 128 recipients, 32.03% (41 of 128 LT recipients) had a hypoplasia PV, 40.63% (52 of 128 LT recipients) had a hepatofugal portal flow and 31.25% (40 of 128 LT recipients) had a high hepatic artery resistance index (HARI) of ≥ 1. Optimal cutoffs for PV diameter, PVVmax, and HARI were 4 mm, 20 cm/sec, and 1, respectively. Sensitivity and specificity were 88.89% and 72.27% for PV diameter, 55.56% and 58.82% for PVVmax, 77.78% and 62.18% for hepatofugal PV flow, and 77.78% and 72.27% for HARI, respectively.
Conclusion: Liver hemodynamic disturbances including PV hypoplasia (32.0%), hepatofugal PV flow (40.63%) and high HARI (31.25%) were mainly observed in BA. Small PV size (≤ 4 mm) are strong warning signs for the prediction of early PVT, and hepatofugal PV flow and high HARI (≥1) had relatively high risk factor.

B-0792 10:39

MR foetal lung volume in congenital diaphragmatic hernia: association of prenatal MR imaging findings with postnatal need for prosthetic patch repair of the hernia

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Purpose: To assess whether the type of surgical closure of the diaphragmatic defect (primary vs. prosthetic patch repair) in neonates with congenital diaphragmatic hernia (CDH) is associated with the antenatal measured observed-to-expected MR-FLV (o/e MR-FLV).
Methods and Materials: Using T2-weighted HASTE imaging, the o/e MR-FLV was calculated in 247 foetuses with isolated CDH between 24 and 40 weeks gestation. Logistic regression analysis and receiver operating characteristics (ROC) analysis were performed to assess the prognostic value of the individual o/e MR-FLV for association with postnatal need for prosthetic patch repair of the hernia.
Results: 77% (190/247) of the patients with CDH required patch repair and in 23% (57/247) the diaphragmatic defect was closed primarily. Patients with patch requirement showed a significantly lower o/e MR-FLV (27.7±10.2%) than patients with primary repair (40.8±13.8%, $p < 0.001$, AUC=0.786). With a prenatally assessed o/e MR-FLV of 20%, 92% of the patients with CDH required patch repair, compared to only 24% of the foetuses with an o/e MR-FLV of 60%. Postnatal patch requirement was further influenced by the liver position (liver herniation vs. no liver herniation) determined during foetal MR examination ($p < 0.001$). Foetal liver position additionally to the o/e MR-FLV improves the prognostic accuracy (AUC=0.827).
Conclusion: Logistic regression analysis based on the prenatally measured o/e MR-FLV is useful for prenatal estimation of prosthetic patch requirement in patients with CDH. In addition to the o/e MR-FLV, the position of the liver determined by foetal MR imaging helps to improve the prognostic accuracy of the estimated probability of patch requirement.

B-0793 10:48

Utility of real-time US-guided percutaneous liver biopsy in paediatric liver transplant recipients

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Purpose: The purpose of this study was to assess the safety of ultrasound (US)-guided percutaneous liver biopsy (PLB) within paediatric liver allograft recipients, to describe the pathological outcomes according to the early (≤12 months) and late (> 12 months) post-transplantation period, and to analyse the value of liver function tests (LFT) and Doppler US variables in determining these outcomes.
Methods and Materials: Two hundred and nineteen consecutive real-time US-guided PLB in 85 paediatric liver transplant patients (mean age 7 years, range 6 months-18 years) performed between March 2005 and May 2012 were retrospectively evaluated. All patients underwent liver function testing and Doppler US evaluation within one day of early (n=92, 42%) and late term (n=127, 58%) post-transplantation biopsy.
Results: All samples were deemed adequate for histological analysis, 2 biopsies (0.91%) had complications consisting of mild bleeding requiring blood transfusion. The early- and late-term biopsy results included cholestasis at 36% vs. 18% (p=.003), no pathology or minimal changes 16% vs. 24% (non-significant, NS), acute rejection 13% vs. 5% (p=.027), inflammatory diseases 15% vs. 15% (NS), indeterminate acute rejection 11% vs. 7% (NS), chronic rejection 4% vs. 14% (p=.017), fibrotic diseases 4% vs. 12% (NS), and other diseases 0% vs. 5% (NS), respectively. Multinomial logistic regression revealed that neither LFT nor US variables are significantly correlated to pathological outcomes.
Conclusion: The rate of complications after US-guided liver biopsy is very low. A range of pathological outcomes exists between early and late post-transplantation liver biopsy. LFT and Doppler US findings are not predictors of pathological outcomes.

B-0794 10:57

Differential effect of right ventricular volume to left ventricular volume in children with repaired tetralogy of fallot

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Purpose: To compare the diagnostic value between indexed right ventricular end-diastolic volume (RVEDVi) and the ratio of right ventricular volume to left ventricular volume (RV/LV ratio) in prediction of the severity of pulmonary regurgitation (PR) after surgery of tetralogy of Fallot (TOF).
Methods and Materials: Tirty-nine consecutive patients with repaired TOF (mean age of operation, 22.33±29.59 months; mean age of MRI, 81.62±50.85 months) were included in the study. RVEDVi, RV/LV ratio, and PR were measured with the use of magnetic resonance imaging (MRI). PR fraction of more than 20% was considered significant. The predictive capability of the two markers (RVEDVi and RV/LV ratio) for significant PR was compared by using multivariate linear regression analysis and receiver operating characteristic analysis (ROC).
Results: A significant correlation between RVEDVi and the RV/LV ratio was demonstrated (r = 0.776, P=0.0001). Both RV/LV and RVEDVi had correlation with PR in correlation analysis (r=0.435/0.353, P=0.006/0.027), but in multivariate analysis, the only independent predictor of PR fraction was the RV/LV ratio (F=8.835, P=0.005). ROC analysis revealed better discrimination of significant (20%) from insignificant (< 20%) PR with the use of the RV/LV ratio than RVEDVi (area under the receiver operating characteristic curve, 0.751 vs 0.711, P =0.01).
Conclusion: The RV/LV ratio is more accurate and useful than the RVEDVi in stratification of PR.

B-0795 11:06

Prenatal diagnosis of fetal abdominal cystic masses: can MR change the outcome?

S. Bernardo, V. Vinci, M. Saldari, P. Sollazzo, F. Capozza, A. Giancotti, L. Manganaro; *Rome/IT*

Purpose: The purpose is to evaluate the role of fetal MRI in predicting outcomes for fetuses with abdominal cystic masses.
Methods and Materials: Forty-nine fetuses with doubtful US for fetal malformation underwent MRI. All MRI findings were compared with ultrasonographic findings regarding detection, anatomical localisation and tissue characterisation. MRI findings were considered to have affected management if subsequent treatment was influenced by the MR findings and diagnosis.
Results: Out of the 49 fetuses, 44 had intra-abdominal cystic masses and formed our study group. The mean GA was 27 weeks. Final individual diagnoses were: meconium pseudocyst (n= 8), mesenteric cyst (n= 4), hydrometrocolpos (n =1), small intestine duplication (n=7), ovarian cyst (n=4), mesenteric lymphangioma (n=4), hydronephrosis with pelvic-ureteric junction obstruction (n= 3), choledochal cyst (n=6), urinoma (n= 2), megaureter caused by posterior urethral valves (n= 1), megabladder (n=3), persistent cloaca (n= 1). MRI was superior to sonography and had supplemental value because of better anatomical localisation in 30 cases. Addition of MRI changed the diagnosis and management in 21 cases. Eleven fetuses had neonatal surgical treatment. In 33 cases, MRI provided additional information than US.
Conclusion: Prenatal MRI enhances fetal anatomic evaluation and facilitates perinatal management and family counseling. Ultrafast imaging sequence MRI is helpful to refine US diagnoses in delineation and characterisation of abdominal cystic masses. Fetal MRI is a valuable adjunct to US for prenatal diagnosis before fetal surgical intervention for selected life-threatening birth defects.

B-0796 11:15

Quantification of aortic pressure gradients by 4D flow MRI in patients with repaired aortic coarctation: comparison to echocardiography

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Purpose: In patients with aortic coarctation, routine follow-up after repair includes measurement of pressure gradients by 2D echocardiography. Purpose of this study was to compare pressure gradient measurements based on 4D flow MRI with 2D echocardiography.
Methods and Materials: 8 patients after repair of aortic coarctation (mean age 15.5 years) underwent 2D echocardiography and 4D flow MRI at 1.5 T with a spatial/temporal resolution of 1.6x1.6x2.1 mm3/28 ms. Pressure gradient measurements by echocardiography based on the simplified Bernoulli equation were used for comparison. Pressure gradients by 4D flow MRI were determined after automatic vessel segmentation applying two different methods: 1, measurement of maximum blood flow velocities in the operated aortic isthmus and calculation of pressure gradients using the simplified Bernoulli equation; 2, computation of 4D pressure difference maps based on the Navier-Stokes equation and measurement of the peak systolic difference between mean pressures directly proximal and distal to the operated aortic isthmus.
Results: Mean pressure gradient by echocardiography was 26.5±10.2 mmHg compared to 18.0±6.9/13.0±6.2 mmHg by MRI Bernoulli method/MRI 4D mapping method. Spearman correlation coefficients were 0.93 (p=0.001) for MRI Bernoulli method and 0.76 (p=0.028) for MRI 4D mapping method. Bland-Altman plots showed consistently lower pressure gradients for both MRI methods compared to echocardiography.
Conclusion: Pressure gradient measurements based on 4D flow MRI showed good correlation with consistently lower pressure gradients compared to routinely performed measurements by 2D echocardiography. Since such differences could be due to the published possible overestimation of echocardiography, further studies need to compare measurements by 4D flow MRI to invasive measurements.
Author Disclosures:
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B-0797 11:24

Acute appendicitis in children: multidetector CT and US findings in negative appendectomy cases

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Purpose: To evaluate the negative appendectomy rate (NAR) among different imaging modalities, age groups and sexes and to describe the findings with US and MDCT that cause radiologists to misdiagnose acute appendicitis in paediatric patients.
Methods and Materials: 382 patients were enrolled by reviewing their medical charts. Among them, 348 patients were confirmed with acute appendicitis, while 26 patients were confirmed as negative for appendicitis. The NAR was compared and the radiological reports and imaging findings from US and MDCT in the negative appendectomy cases were retrospectively reviewed.
Results: Overall, the NAR was 7.0%. The NAR was lowest in the group receiving MDCT only (5.6%), was highest in age group of 0-4 years old (14.7%), and was higher in the male paediatric population (9.2%), but there were no statistically significant differences. The most common misleading finding in US was equivocal dilatation of the appendix with associated sonographic tenderness and/or noncompressibility (13/16, 81%). The two most common misleading findings in CT were the borderline diameter of the appendix with appendicolith or hyperdense fecalith (5/12, 42%) and secondary inflammatory changes in the appendix (4/12, 33%). In almost all the negative appendectomy cases, periappendiceal fat inflammation was not present on the imaging studies.
Conclusion: The radiologists may misdiagnose acute appendicitis, especially when sonographic tenderness or noncompressibility is present on US

examination, and an appendicolith or hyperdense fecalith is noted on the MDCT scan. The absence of periappendiceal fat inflammation either on US or MDCT, provides some clues for the exclusion of acute appendicitis.

B-0798 11:33

Imaging features of childhood desmoplastic small round cell tumour

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Purpose: Desmoplastic small round cell tumour (DSRCT) is a rare aggressive malignant small cell neoplasm tends to occur in children and adolescents, who present with vague abdominal discomfort or distention and are often evaluated with cross-sectional imaging. Our purpose is to review the imaging features, histopathology and outcome of 10 patients with DSRCT treated at a single institution.
Methods and Materials: This is a retrospective observational study of patients with DSRCT who presented to our hospital between 2010 and 2013. Ten paediatric patients with pathologically proven DSRCT seen during this period. Results of imaging studies (CT in the ten patients, ultrasonography [US] in three) and histopathologic specimens were analysed.
Results: The cohort of 10 patients included 1 male (1%) and 9 females (90%) with a mean age of 12.7 years (range 9 to 17 years). The peritoneum affected in the majority of cases (n=9) and pleura is affected only in one case. There were 3 patients (33%) had metastatic disease at presentation. The hallmark imaging feature was diffuse peritoneal thickening with multiple focal lobulated peritoneal masses (n=6). Less common multiple focal peritoneal masses (n=3). Ascites was present in five patients. Calcification was encountered in one patient.
Conclusion: Desmoplastic small round cell tumour is uncommon, aggressive small-cell tumour typically presenting with multiple large serosal soft-tissue masses. The imaging of this tumour is somewhat nonspecific, yet this uncommon diagnosis should be considered in assessment of young female teenager presenting with widespread peritoneal malignant disease without certain solid organ involvement.

B-0799 11:42

Noninvasive quantitative 4D pressure difference mapping derived from 4D flow MRI shows alterations in patients with repaired aortic coarctation

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Purpose: To assess spatial and temporal pressure characteristics in patients with repaired aortic coarctation compared to young healthy volunteers using 4D pressure difference maps derived from 4D flow MRI.
Methods and Materials: 13 patients after aortic coarctation repair without recoarctation (mean age 18.8 years) and 13 healthy volunteers (mean age 22.9 years) underwent 4D flow MRI of the thoracic aorta at 1.5 T. Spatial/temporal resolution was 1.6x1.6x2.1 mm3/28 ms. 4D pressure difference maps relative to the proximal ascending aorta were computed based on the Navier-Stokes equation. The thoracic aorta was divided into four segments: ascending aorta, aortic arch, proximal descending aorta and distal descending aorta. For each segment, spatial pressure range at mid systole and maximum slope of local pressure amplitudes were determined.
Results: Mean spatial pressure range at mid systole for patients/volunteers was (in mmHg): ascending aorta 1.8/1.6 (p=ns), arch 4.8/1.7 (p=0.02), proximal descending 8.9/1.6 ($p < 0.001$) and distal descending 2.8/1.6 (p=0.002). Mean maximum slope of local pressure amplitudes for patients/volunteers was (in mmHg/cm): ascending aorta 7.4/2.5 (p=ns), arch 6.6/2.1 ($p < 0.001$), proximal descending 12.1/1.9 (p=0.002) and distal descending 3.9/2.1 (p=0.002).
Conclusion: Noninvasive quantitative 4D pressure difference mapping derived from 4D flow MRI showed significant alterations of spatial and temporal pressure characteristics in patients with repaired aortic coarctation compared to young healthy volunteers, particularly affecting aortic arch and proximal descending aorta, but also distal descending aorta. The technique may evolve into a noninvasive alternative to catheterisation in coarctation follow-up.
Author Disclosures:
H. von Tengg-Kobligk: Research/Grant Support; W. L. Gore & Associates, Inc. **H.-U. Kauczor:** Research/Grant Support; Boehringer Ingelheim GmbH, Siemens AG. Speaker; Boehringer Ingelheim GmbH, Bayer AG, Siemens AG.

10:30 - 12:00 **Room E1**

Musculoskeletal

SS 1710

Hip and artefacts reduction

Moderators:
P. Omoumi; Brussels/BE
A.P. Toms; Norwich/UK

B-0800 10:30

Measurement of acetabular cup orientation after total hip arthroplasty in standing and sitting positions with a novel low dose biplanar slot scanner

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Purpose: Improper positioning of the acetabular cup after total hip arthroplasty (THA) is a cause of dislocation. Cup orientation (CO) is assessed with a computed-tomography (CT) scan in the supine position. Slot scanner (SS) allows a three-dimensional (3D) assessment of CO in standing and sitting positions. The aim was to evaluate the interest of SS to assess CO.
Methods and Materials: Fifteen THA patients were included after dislocation. After reduction, a scan and SS acquisitions were performed to measure cup anteversion both in the standing and sitting positions. 3D modelling of the pelvises was performed by two independent observers with a dedicated software, cup inclination and anteversion were calculated. Variations of cup anteversion and inclination between the different positions were detected with the student t-test. The interobserver agreements of the SS evaluation of CO were assessed with the intraclass correlation coefficient (ICC).
Results: CT measurement of cup anteversion was 23.3°. SS measurement of cup anteversion was 24.4° in the standing position and 37.2° in the sitting position ($p < 0.01$). CT measurement of cup anteversion did not differ significantly from SS measurement in the standing position (p=0.9), but the difference between CT and SS was statistically significant when considering the sitting SS acquisition ($p < 0.01$). SS measurement of cup inclination was 43.6° in the standing position and 50.6° in the sitting position ($p < 0.01$).
Conclusion: Cup orientation shows significant variations between stand-up and sat positions. SS might be a relevant and reliable tool to understand cases of hip dislocations occurring during postural changes.

B-0801 10:39

Improving sensitivity of conventional MR arthrography in detection of arthroscopically confirmed lig. teres lesions subsequent to FAI by adding axial leg traction

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Purpose: Recent research focuses on the increasing relevance of lig. teres lesions as contributors to hip pain and instability. Detection of these lesions is challenging, thus it was aimed to improve diagnostic performance of MR arthrography by adding leg traction.
Methods and Materials: Out of 135 patients with FAI, 48 imaging studies (mean age 34.6a, 34 mixed-, 12 cam-, and 2 pincer-type) with confirmed lig. teres lesions were selected. MR arthrograms were obtained according to the institutional routine protocol using a 1.5 T scanner and an intraarticular injected volume of up to 30 ml. Weight load ranging from 15 to 23 kg was adapted to constitution and applicated with a dedicated traction device. Lesions were graded as partial tear (type 2; subtotal fluid interposition and/or ligamentous flap) and degeneration (type 3; hypertrophy ± mucoid degeneration) on coronal images ± traction. Overall sensitivity and sensitivity for each imaging modality as such was calculated.
Results: Overall sensitivity was 85.3% (35/41), 100% (7/7) for type 2, 3 lesions, respectively. Sensitivity of imaging analysis without traction was 60.9% (25/41) for type 2 and 57.1% (4/7) for type 3 lesions. 10 type 2 (P = 24.3%) and 3 type 3 lesions (P = 42.8%) were only seen with traction.
Conclusion: Traction improved detection of lig. teres lesions. It is hypothesised that traction during MR arthrography enables visualisation of the ligament more similar to the arthroscopic point of view that reflects a more lax condition of stress thereby facilitating the evaluation of flaps, intrasubstantial fluid accumulation and hypertrophy.

B-0802 10:48

Femoroacetabular impingement pattern of hip involvement in ankylosing spondylitis

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Purpose: To evaluate FAI patterns of hip involvement in AS and correlate with sacroiliitis grades.
Methods and Materials: 153 patients with AS were analysed regarding radiologic signs of FAI, sacroiliitis grades. FAI was classified according to alpha angle, lateral center-edge (CE) angle, crossover sign, pistol grip deformity. Prevalence of FAI types was determined and evaluated for association with sacroiliitis grades. Alpha angles were measured on translateral radiographs or oblique axial CT/MR images. Lateral CE angle, crossover sign, pistol grip deformity were measured on AP radiographs. Sacroiliitis was graded according to New York criteria. Cam type FAI was considered if flattening of head-neck junction (pistol grip deformity) and/or alpha angle> 50°; pincer FAI if lateral CE angle > 39°, and/or positive crossover sign; combined type with findings of both types. Statistical analysis was done using Chi-square test for gender, T-test for age, sacroiliitis score, Kruskal-Wallis test for sacroiliitis score, Mann-Whitney U-test, corrected by Bonferroni methods.
Results: 53 (34.6%) had FAI pattern of hip. Male predominance was found (84.9%) (p=0.031). Hip involvement group showed greater sacroiliitis score (p=0.001). Regarding type of FAI (n=53), pincer was most common (n=25). Sacroiliitis grade was different among FAI types (p=0.002). Combined-type FAI pattern (n=20, 3.20±0.77) had greater sacroiliitis score (p=0.018).
Conclusion: FAI pattern of hip involvement was frequent in AS (34.6%), more frequent in males, associated with greater sacroiliitis grade. FAI type of hip involvement should be considered in AS patients with hip symptoms and managed accordingly.

B-0803 10:57

How common are hip labral tears? Comparison of individuals with and without hip symptoms

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Purpose: To compare frequencies of hip labral tear in individuals with and without hip symptoms
Methods and Materials: Ninety volunteers (49 male and 41 female, age range 23-72) were prospectively recruited for this cross-sectional study. All underwent non-contrast 3 T MRI and clinical assessment for hip symptoms. Three-plane non-contrast intermediate-weighted fast spin echo imaging sequences were performed of the hip. Images were analysed for labral pathology and other significant hip joint findings. Labral abnormalities were classified into 4 groups, any tear, intra-substance tear, complex tear and maceration. Hip pain, stiffness, noise such as clicking or grinding and stiffness were assessed on a 5-point scale using the Hip Osteoarthritis Outcome score (HOOS) questionnaire. Chi-square test was performed to assess the difference of labral abnormality frequency in each symptom subgroup.
Results: Hip pain, noise and stiffness were reported in 49, 25 and 38 of the 90 subjects. The frequency of labral abnormalities were, any tear 91.1 %, intra-substance tear 58.8 %, complex tear 43.3 % and maceration 14.4 %. No significant differences in overall frequency of hip tears were found between subjects with and without symptoms; individuals with hip stiffness, however, showed a statistically significant higher number of complex tears (P=0.01) and a statistical trend toward increase in intra-substance tears (P=0.06).
Conclusion: A high percentage of labral tears were found in individuals with and without hip pain, noise and stiffness. The only clinical symptom with statistical frequency increase of hip labral abnormality was hip stiffness, which was associated with complex tears.

B-0804 11:06

Value of lower-limb MRI examination for the prediction of joint collapse in haematological paediatric patients with osteonecrosis of femoral heads and condyles: role of lesion volume assessment

A. Masetto, D. Ippolito, P.A. Bonaffini, A. Casiraghi, V. Besostri, S. Sironi; *Monza/IT (dr.masetto@gmail.com)*

Purpose: To assess the reliability of the measurement of the osteonecrosis volume as predictive factor of joint collapse in femoral heads and condyles of paediatric patients treated for haematologic malignancies.
Methods and Materials: A total of 120 patients with lymphoproliferative diseases, treated with chemotherapy and corticosteroids and/or bone marrow transplant, with suspicion of osteonecrosis, underwent a lower-limb MRI examination between June 2005 and January 2013. Studies were performed at baseline and during follow-up on a 1.5 T magnet, acquiring coronal STIR and T1-weighted sequences from the hips to the ankles. On baseline MRI, the volumes of femoral heads (FHs), medial condyles (MCs), lateral condyles (LCs) and the osteonecrosis volume (ONV) were measured. The volumetric involvement (relative volume, RV) of the bone by necrosis was calculated (ONV/epiphyseal bone volume). Statistical analysis was performed with ROC curve test.
Results: Twenty-six patients (9 males, mean age 15 years) presented ON affecting femoral heads and/or condyles, for a total of 23 FHs, 23 MCs and 28 LCs. During the follow-up (11±2 months), joint deformity was observed in 12 FHs, 2 MCs and 5 LCs. Considering a threshold of 24% of volume involvement, RV predicted joint deformity in 12/12 FHs, with sensitivity=100%, specificity=90%, accuracy=95%, PPV=93%, NPV=100%. Using a threshold of 27% and 11% of volume involvement, RV predicted joint deformity in 2/23 (8%) MCs (sensitivity=100%, specificity=57%, accuracy=61%, PPV=9%, NPV=100%) and in 5/28 (18%) LCs (SN=100%, specificity=35%, accuracy=46%, PPV=25%, NPV=100%), respectively.
Conclusion: In haematological paediatric patients with post-treatment osteonecrosis, RV showed high prognostic value for the prediction of deformity in femoral heads, but not in femoral condyles.

B-0805 11:15

Model-based iterative reconstruction: reduction of metal artefact on CT images

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Purpose: To reduce artefacts resulting from implanted metal prosthesis on CT images using model-based iterative reconstruction (MBIR).
Methods and Materials: A total hip prosthesis, screws and metal plates were scanned in vitro (CT Discovery, GEMS). Images were reconstructed with filtered-back projection (FBP) and MBIR algorithms, and the size of the resulting artefacts on each image series was measured. CT scans obtained with the same scanner in 63 patients with similar implants were reconstructed with FBP and MBIR. The visibility of the interface between metal and bone and of the neighbouring soft tissue structures was recorded on each set of images and graded on a 3-point scale.
Results: In vitro, the mean size of the artefacts was 1.4 cm^2 with FBP and 0.25 cm^2 with MBIR corresponding to a reduction of 80%. In vivo, the size of the artefacts decreased from 6.46 to 3.53 cm^2 ($p < 0.0001$) when using MBIR. The interface between metal and bone was equal or better visible on images reconstructed with MBIR than on those with FBP in 85% of cases ($p < 0.05$), and the results for soft tissue evaluation were better in 75% of cases ($p < 0.05$) particularly in pelvis.
Conclusion: Both qualitative and quantitative results showed that the MBIR improve image quality by reduction of artefacts and better assessment of the adjacent structures.

B-0806 11:24

WARP imaging of metal-on-metal hip resurfacing arthroplasty at 1.5 T and 3 T MRI compared to standard imaging techniques: what more do we see?

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Purpose: To evaluate the metal artefact reduction technique WARP (Siemens Healthcare) for the assessment of metal-on-metal hip resurfacing at 1.5 T and 3 T according to advantages and disadvantages over standard MR-sequences, focused on the detection of pseudotumours.
Methods and Materials: 23 arthroplasties (Conserve plus, Wright Medical Technology) were evaluated 3 - 9 years after surgery, randomised for 1.5 T and 3 T MRI. Additionally eight patients were examined at both field strengths using the same protocol: TIRM, T1w and T2w TSE in coronal and axial orientation, each with and without WARP (Bandwidth: 558 Hz/px (HBW), view-angle-tilting 100% (VAT)). Sequences were evaluated regarding artifacts (size; 5-point-scale: 1= no artifacts, 5= nondiagnostic), delineation of soft-tissue structures (3-point-scale: 1= fully visible, 3= not visible) and the existence of pseudotumours. The results were compared between the correlating sequences.
Results: WARP showed less quality degradation through artefacts (i.e. 1.5 T TIRM: 3.9 ±0.3 vs. 4.9 ±0.2) and smaller artefacts (i.e. 3 T T1w: 87.4 ±9.0 mm vs. 100.6 ±3.8 mm). The delineation of soft tissue structures was better with WARP (i.e. internal obturator tendon at 1.5 T T1w: 1.8 ±0.4 vs. 2.6 ±0.5). WARP showed only slightly better results then HBW alone for the size of artefacts. Pseudotumours appeared in 5 cases (19 - 30 mm), which could be seen with and without WARP.
Conclusion: WARP is feasible at 1.5 T and 3 T for imaging hips after metal-on-metal resurfacing and provides better image quality then standard sequences. WARP shows a slight advantage over HBW alone. Detected pseudotumours did not profit from WARP.

B-0807 11:33

Usefullness of slice encoding metal artefact correction for reducing metal artefact after spinal instrumentation

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Purpose: To compare metal artifact reduction after spinal instrumentation in MRI at 1.5 T using novel MRI sequence strategies.
Methods and Materials: Two sequences were compared for the imaging of metal implants after spinal instrumentation: a slice encoding sequence for metal artifact correction (SEMAC) and a standard sequence. Images were acquired on a 1.5 T system. 13 patients with titanium implants and 2 patients with stainless steel implants were evaluated. Degree of artifact reduction was assessed quantitatively and qualitatively by both, artifact measurements and a blinded read. The images were ranked on the basis of the following parameters: artifact size, distortion of normal structures, and the ability to visualise the bone marrow, bone cortex and soft tissues. The SEMAC technique was compared directly to the standard sequence.
Results: In comparison to conventional sequences artifact size was 45% less utilising SEMAC. In terms of bone marrow, bone cortex and soft tissue visualisation SEMAC was ranked superior to the corresponding standard sequence. Distortion was less with SEMAC. For the evaluation of blur, the standard images were ranked superior to the corresponding SEMAC sequence. In terms of overall image quality, SEMAC was ranked superior to the standard sequence.
Conclusion: SEMAC effectively reduces artifacts caused by metallic implants after spinal instrumentation relative to standard imaging. This allows for an improved detectability of postoperative complications such as epidural inflammation or hematoma.

B-0808 11:42

Dual-energy CT of hip prosthesis: metal artefact reduction system image and 140keV monochromatic image contrast and noise on non-prosthesis side

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Purpose: To compare image quality (SNR, CNR) on non-hip prosthesis side in dual-energy CT examinations obtained with different protocols: with metal artefact reduction system (MARS) and high energy (140 keV) monochromatic reconstruction without MARS.
Methods and Materials: Hip prosthesis studies of 31 consecutive patients (mean age 68 yrs) after hip prosthesis revision surgery were examined, using DECT (GE Discovery CT750HD; 64x0.625 mm; pitch 1:1.375, 600 mAs). From each patient, two series of monochromatic energy scan were obtained. First with MARS and 75keV and second without MARS, 140keV. Two blind radiologists reviewed two series of monochromtic image of DECT examinations assessing image noise (SNR), contrast (CNR) on the side of hip prosthesis and in mirror contralateral region. SNR and CNR in fat muscle for prosthesis' side and opposite side were measured on the level of femoral head.
Results: There were no statistically significant differences between SNR of fat on hip prosthesis and opposite site (4.8 vs. 5.2, p=0.07) in MARS image. However, significant difference between SNR was found in 140keV images (3.9 vs. 5.3, p=0.0001). Differences between CNR (fat/muscle) of both sides on MARS and 140keV images were: 5.5 vs. 6.8, p=0.05; 5.9 vs. 7.3, p=0.05, respectively.
Conclusion: In the monochromatic 140 keV image on non-prosthesis side, the significant lower level of noise was detected. We propose to perform MARS reconstruction in high voltage level.

B-0809 11:51

Reduction of metal artefact from cobalt-chromium-molybdenum alloy hip prostheses in gemstone spectral imaging dual-energy CT with and without metal artefact reduction software

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Purpose: To assess the usefulness of gemstone spectral imaging (GSI) dual-energy CT (DECT) with/without metal artefact reduction software (MARs) in cobalt-chromium-molybdenum alloy hip prostheses, and to detect the optimal photon energy setting.
Methods and Materials: This study had institutional review board and local ethics committee approval. The DECTs were performed using fast kV-switching GSI between 80 and 140 kV. The CT data were reconstructed with/without MARs, and with synthesized monochromatic energy in the range of 70-140 keV with 10 keV interval. Seventeen in vivo cobalt-chromium-molybdenum alloy total hip prostheses of 11 unilateral implanted patients and 3 bilateral implanted patients were included. Two independent readers evaluated the visualisation of periprosthetic regions and the severity of artifacts according to a 4-score scale. CT attenuation of gluteus maximus muscle ipsilateral to the side of the replaced hip from non-metal level, acetabular cup and femoral head level, femoral neck level, and femoral shaft level were measured. Statistical analysis included the Chi-square test, and Friedman test.
Results: The GSI-MARs reconstruction markedly reduced the cobalt-chromium-molybdenum alloy hip prostheses related artifacts ($P < 0.05$). CT attenuation of gluteus maximus muscle in GSI-MARs images from the acetabular cup and femoral head level ($\chi2=4.765$, P=0.029), femoral neck level ($\chi2=13.235$, P=0.000), and femoral shaft level ($\chi2=7.118$, P=0.008) was much closer to the reference non-metal level. Optimal metal artefact reduction and image noise could be achieved above 100 keV.
Conclusion: GSI-MARs reduced metal artefacts from cobalt-chromium-molybdenum alloy hip prostheses. Optimal energy range was found between 110 and 140 keV.

10:30 - 12:00 **Room E2**

Head and Neck

SS 1708

Thyroid and parathyroid glands

Moderators:
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B-0810 10:30

Role of TIRADS in nodular thyroid disease

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Purpose: 1. To classify nodular thyroid disease according to TIRADS classification. 2. To correlate TIRADS categories with the rates of malignancy in each category, in select study population. 3. To assess reliability of TIRADS classification.
Methods and Materials: 219 nodules were evaluated by B-mode imaging and colour Doppler. These nodules were classified into TIRADS grades according to the guidelines proposed by Horvath et al. The TIRADS subgroups (based on B-mode imaging and colour Doppler) were compared with the cytopathological diagnosis and analysed statistically using Chi-square test, and logistic regression analysis to find out the correlation between the sonographic variables and final cytological end result. The odds ratio for malignancy for each TIRADS group was calculated thereby. "SSPS for Windows, Version 17" was used for the statistical analysis.
Results: TIRADS is a system of classification for categorisation of thyroid nodules. As such it can be used to predict tissue morphology, whether benign or malignant. According to our study, univariate logistic regression of TIRADS 2 to TIRADS 4B with malignancy has an odds ratio (OR) of less than 1 with a significant confidence interval. TIRADS has a statistically significant OR of more than 1 when compared with malignancy.
Conclusion: TIRADS is a novel method of categorising nodular thyroid disease. It helps in classifying these into benign and malignant according to sonographic features. Thus, the need of biopsy can be reduced.

B-0811 10:39

Non-diagnostic results of fine needle aspiration cytology of thyroid nodules

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Purpose: Fine needle aspiration (FNA) cytology has a central place in the diagnosis of thyroid gland nodules. We evaluated the proportion of non-diagnostic cytology results after first and after repeat FNA. Also the effect of operator experience was evaluated.
Methods and Materials: 483 cytology results of FNA performed in our institution in 2010, 2011 and 2012 were available for retrospective analysis. 77 were excluded from further analysis (70 previous FNA before 2010, 3 second repeat FNA, 4 interval > 6 months). 406 remaining cytology results in 336 patients were dichotomised using the Bethesda system with 1 as non-diagnostic and 2 to 6 as diagnostic. Operator experience was categorised as experienced (staff radiologist) or inexperienced (radiology resident). Differences were analysed using the Chi-square test.
Results: The cohort consisted of predominantly females (N=250, 74%). Mean patient age was 52.6 (median 53, 14-93). Non-diagnostic cytology occurred in 98 of 353 initial FNA (28%). Non-diagnostic cytology occurred in 20 of 53 repeat FNA (38%). Total non-diagnostic cytology after second FNA was 21%. Approximately, 40% of the FNA was performed by a staff radiologist. There was no significant difference between experienced and inexperienced operators (25% and 32%; p=0.13).

Conclusion: Although FNA cytology is a valuable tool in the evaluation of thyroid gland nodules there is a high proportion of non-diagnostic test results (28%). It is important to repeat FNA cytology because diagnostic results are obtained in 62% of the previously non-diagnostic FNA. In this study, non-diagnostic FNA cytology is not influenced by operator experience.

B-0813 10:48

Difficulties in the performance of ultrasound elastography of thyroid malignancies

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Purpose: To analyse disadvantages, difficulties, and artifacts during ultrasound elastography of thyroid cancer.
Methods and Materials: Ultrasound examinations with elastography of 141 patients with verified thyroid cancer were analysed. The reference group with verified benign nodules included 432 persons. The scanners S2000 (Siemens-Acuson), SonixSP (Ultrasonix), DC-8 (Mindray) with linear 7.5-15 MHz probes were utilised.
Results: The efficacy of the combination of compression and share-wave elastography in diagnosis of thyroid cancer was characterised with sensitivity of 96.4% and specificity of 90.1%. Compression elastography was accompanied with difficulties in interpretation in 13 cases (9.2%). In 4 cases (2.8%) the artifact of excessive color pattern within the malignant lesion was observed, while 9 cases (6.4%) had the artifact of poor (deficiency or absence) color pattern or absence of difference between the color of the lesion and the surrounding thyroid parenchyma. However, all lesions were well visualised in other ultrasound regimens. Artifacts during compression elastography resulted from inadequate adjustments of equipment, "noise" due to thyroid lesion location, different approaches in image processing in scanners of different manufacturers, significant operator-dependency of the technology. Difficulties in the performance of share-wave elastography were experienced in 12 (14.9%) cases. They were the consequence of substernal thyroid location, subcentimetric or large (> 3 cm) lesions, prominent heterogeneity of lesions, and severe background changes in thyroid parenchyma. In 9 cases (6.4%) compression elastography and share-wave elastography exhibited discordant results.
Conclusion: Effective acquisition and interpretation of elastographic images demands certain knowledge, skills, and experience with complex analysis of quantitative and qualitative data.

B-0814 10:57

Q-elastography in the presurgical evaluation of thyroid nodules with indeterminate cytology: bicenter experience on large population

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Purpose: To assess the role of Q-Elastography (Q-USE) in the characterisation of thyroid nodules with indeterminate cytology (Thy3).
Methods and Materials: 260 nodules in 220 patients (185 females; 75 male patients) with Thy3 (mean age 50 years, range 18-78) were prospectively and consecutively enrolled in two specialised University Centers. All patients underwent multiparametric CDUS and Q-USE evaluation measuring the Strain Ratio (SR) and then underwent surgery or FNAC. To evaluate the relationship between categorical data and final histological outcome, univariate analysis with the chi-square test and multiple logistic regression analysis was performed. Sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy were calculated. Cut-off value for strain ratio was calculated by Receiver Operating Characteristic (ROC) analysis, with Areas Under the Curve comparison with Bonferroni test. Histopathology was the gold standard.
Results: Malignant nodules were 95; while the benign were 165 (18 adenomas and 147 hyperplastic nodules). A higher Strain Ratio in malignant nodules than benign ones was demonstrated, with an optimum SR cut-off equal to 2 obtained with ROC analysis. Hypoechogenicity, irregular margins and SR ≥2 showed accuracy of 69%, 80% and 91%, respectively. A multivariate analysis showed a significant association between the SR and margins irregularity, thus confirming the univariate analysis findings. The diagnostic accuracy of hypoechogenicity (ROC area = 0.6725) was significantly lower than that of the strain ratio (p,0.0001) and irregular margins (p = 0.0092).
Conclusion: Q-USE is a useful additional tool to Color-Doppler US in the differential diagnosis of thyroid nodules with indeterminate cytology.

B-0816 11:06

A novel application: the role of ARFI sonoelastography for the diagnosis of chronic autoimmune Hashimoto's thyroiditis

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Purpose: The aim of this study was to prospectively assess the applicability of real-time acoustic radiation force impulse (ARFI) sonoelastography in diagnosis of chronic autoimmun thyroiditis (CAT). This study revealed and compared the thyroid tissue stiffness in patients with CAT with healty control subjects (CS).
Methods and Materials: The study group consist of 50 patients with first-diagnosed CAT and 40 CS matched for age and gender. ARFI sonoelastography was performed at 2-3 days before the exact diagnosis and treatment initiation. In all patients with CAT and CS, 10 sonoelastographic measurements were made in the everyone of thyroid lobe. Median values were calculated for thyroid stiffness (TS) and expressed in meters/second (m/s). The diagnostic performance of ARFI sonoelastography was evaluated using ROC curves. Optimal cut-off values were chosen to maximise the sum of sensitivity and specificity. Positive predictive value (PPV), negative predictive value (NPV), and accuracy values were also calculated.
Results: TS assessed by means of ARFI in CAT patients (2.55 ± 0.32 m/s) was significantly higher than in CS (1.63 ± 0.13 m/s) ($P < 0.0001$). The optimal cut-off value for the prediction of CAT was 2.03 m/s. For this cut-off value TS had 85% sensitivity, 90% specificity, 92% PPV, 81% NPV, and 87% accuracy for the presence of CAT.
Conclusion: ARFI sonoelastography seems to be useful method for the pre-diagnosis assessment of CAT patients.

B-0817 11:15

Does new FDG-PET/CT64 show different uptake values than in previous PET scans in thyroid incidentalomas (TI)?

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Purpose: Ultrasound fine needle aspiration cytology (USFNAC) has been proved to be a useful tool in the characterisation of TI detected with FDG-PET as well as new PET/CT64 devices show higher uptake than previous ones in small lesions. The aim of the study is to determine whether TI characterised by USFNAC and histology, detected with FDG-PET/CT64, FDG-PET/CT2 and FDG-PET showed different standard uptake values (SUVmax)
Methods and Materials: Sixty-five TI were studied with USFNAC,11 of them with histology after thyroidectomy,54 were benign and 11 malignant.Fourteen were studied with FDG-PET-(group1),37 with FDG-PET/CT2-(group2) and 14 with FDG-PET/CT64-(group 3).SUVmax was calculated and the values obtained comparing the 3 devices. Data were expressed as mean ± S.D. T-Test, ANOVA and non parametric tests were applied.
Results: SUVmax was 3.5±1.1 for group 1, 5.6±3 for group 2 and 6.9 ± 6.9 for group 3 (p= 0.08).SUVmax for 54 benign lesions was 4.9±2.6 (range1.4-13.7) and for 11 malignant lesions was 8.1±7.8 (range 2.2-26.4) (p=0.02). In group 1, SUVmax for benign lesions was lower than for malignant ones (3.4±1.2 vs 3.9±0.5 p=NS), as well as in group 2 (5.4±2.4 vs 6.9±5.9 p=NS) and in group 3 (4.9±3.5 vs 14.4±12.1 p=0.003).
Conclusion: SUVmax values of TI detected with FDG-PET/CT64 were higher than those obtained with FDG-PET/CT2 and FDG-PET, with no significant differences.Even though malignant TI presented significantly higher SUVmax values than benign ones, some overlap was found, and these differences were only detected by FDG-PET/CT64. FNAGUS is required to characterise TI because there is overlap between benign and malignant lesions.

B-0818 11:24

Preoperative detection of parathyroid adenomas with 3 T MRI in patients with hyperparathyroidism

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Purpose: To identify MRI features of parathyroid adenomas in patients with primary hyperparathyroidism, using a fast protocol with a 3 T MR scanner.
Methods and Materials: 22 patients with primary hyperparathyroidism with US and Tc-99 sestamibi positive scans were enrolled and submitted to preoperative MR scan. MRI imaging was performed on a 3 T unit using a dedicated protocol: T2 IDEAL sequences on three-plane and axial T1 IDEAL sequences before and after administration of 10 ml of gadolinium. The average scan time was 16 minutes. Once the adenoma was identified, two radiologists in consensus evaluated the presence of five features: hyperintensity, homogeneous or marbled appereance and oblong shape on T2 IDEAL sequence; cleavage plane from thyroid gland shown by "Indian Ink artefact" on T2 outphase IDEAL; rapid enhancement in post-contrast T1-weighted images.

Results: Radiologists identified adenomas as hyperintense on T2 IDEAL sequence in 29/29 (100%), marbled in 23/29 (79.3%) and oblong in 26/29 (89.7%). "Indian ink artefact" on T2 outphase IDEAL was noticed in 23/29 (79.3%) and a rapid enhancement on T1-weighted sequence in 9/29 (31%).
Conclusion: This study demonstrates that some MR features recurs in high percentage. In particular, we detected the hyperintensity in all cases; marbled and oblong appereance on T2 IDEAL sequence and the presence of "Indian ink artefact" on T2 outphase IDEAL were also frequently observed.

B-0819 11:33

The success of MRI in preoperative detection of primary hyperparathyroidism focus and contribution to other imaging methods
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Purpose: Single parathyroid adenoma is the most common cause of primary hyperparathyroidism (HPT). HPT focus should be detected before minimally invasive surgery. Our aim is to investigate the success of magnetic resonance imaging (MRI) and contribution of it to other imaging methods in detecting primary HPT focus.
Methods and Materials: One hundred fifty-nine parathyroid lesions of 150 patients, detected and pre-diagnosed by using MRI (159), ultrasound (US)(159), ^{99m}Tc-MIBI scintigraphy (159), SPECT (73) and SPECT/CT (85), proven pathologically after surgery, were evaluated retrospectively.
Results: Parathyroid lesions were classified as normal/ectopic location, single/double, hyperplasia and reoperated lesions. Success ratios of imaging techniques were calculated when they were used single and together with others.When single or more imaging techniques were used for investigation of parathyroid lesions, general sensitivity, sensitivity in ectopic lesions and double adenomas, accurate detection rates of re-operated lesions are: MRI: 68.2%; 72.7%; 38.9%; 71.4%, US:80.3%; 54.5%; 50.0%; 42.8%, MIBI planar: 69.7%; 81.8%; 55.6%; 85.7%, SPECT: 68.4%; 80%; 62.5%; 50%, SPECT/CT: 86.5%; 87.5%; 81.1%; 100%, MRI+US: 90.2%; 81.8%; 72.2%; 100%, MRI+MIBI:82.6%; 90.9%; 72.2%; 85.7%, MRI+SPECT: 80.7%; 80.0%; 75.0%; 71.4%, MRI+SPECT/CT: 87.8%; 87.5%; 81.8%; 85.7%, US+MIBI: 94.7%; 90.9%; 88.8%; 85.7%, MRI+US+MIBI: 96.2%; 100%; 94.4%; 100%, MRI+US+MIBI+SPECT: 98.2%; 100%; 100%; 100%, MRI+US+MIBI+SPECT/CT: 97.3%; 100%; 100%; 100%, respectively.
Conclusion: Although MRI is not the first imaging technique in primary HPT routinely, it increases the accuracy rates in the cases of insufficiency of US and MIBI scintigraphy and particularly in detection of ectopic lesions, double adenomas and re-operated parathyroid lesions, when used as additonal imaging method.

10:30 - 12:00 **Room F1**

Oncologic Imaging

SS 1716

PET/CT as diagnostic and prognostic biomarker

Moderators:
A. Pomoni; Lausanne/CH
N.N.

B-0820 10:30

The impact of PET-CT in detecting non-nodal extrathoracic metastases in lung cancer compared to the staging CT
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Purpose: NICE Lung Cancer Guidelines 2011 recommend performing a PET-CT after a staging CT prior to radical treatment. As CT detects mediastinal lymphadenopathy and intervention determines its aetiology, the true value of PET-CT is in detecting non-nodal extrathoracic metastases. The yield of PET-CT in detecting non-nodal extrathoracic metastases has not been reported in comparison to that of reviewing the prior staging CT.
Methods and Materials: 235 consecutive lung cancer patients with no known extrathoracic metastases referred for a PET-CT prior to radical therapy underwent a contrast-enhanced neck, chest and liver CT and whole body PET-CT.
Results: The median age was 72 years, 141 men (60%). Patients had stage Ia (16%), Ib (19%), IIa (6%), IIb (7%), IIIa (25%), IIIb (6%) and IV (20%) disease. The median interval between CT and PET-CT was 25 days (IQR, 18-29). 21 (9%) patients had 25 extrathoracic and extra-cerebral metastases. 9 metastases were identified on PET-CT and review of the prior staging CT. 16 metastases were invisible on the staging CT; 4 bone metastases were outside the field of view, 6 had developed since referral (median interval 28 days; IQR, 19-39), and 6 were only identified on PET-CT.
Conclusion: PET-CT detects extrathoracic metastases which were missed or invisible on the staging CT. Lung cancer patients should be offered a contrast-enhanced pelvic CT in addition to the neck, chest, abdomen CT at staging to increase the detection of extrathoracic metastases. An interval CT should be performed if the PET-CT is delayed by greater than 30 days.

B-0821 10:39

Fluorodeoxyglucose positron emission tomography and chemotherapy-related tumour marker expression in non-small cell lung cancer
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Purpose: The chemotherapy resistance of non-small cell lung cancer (NSCLC) remains a clinic challenge and is closely associated with several biomarkers including epidermal growth factor receptor (EGFR), p53 and excision repair cross complementing gene 1 (ERCC1). FDG-PET is the best non-invasive surrogate for tumour biology with the maximal standardised uptake values (SUVmax) being the most important paradigm. The purpose of this study was to determine the correlation of chemotherapy related tumour markers with FDG-PET SUVmax in NSCLC.
Methods and Materials: FDG-PET SUVmax were calculated in patients with NSCLC (n = 62) and immunohistochemical analysis was performed for EGFR, p53 or ERCC1 on the intraoperative NSCLC tissues. The SUVmax difference based on the histologic characteristics, gender, differentiation, grading and age as well as correlation analysis among these parameters were performed. Multiple stepwise regression analysis was further performed to determine the primary predictor for SUVmax.
Results: The significant age, tumour size, p53 positivity or ERCC1 positivity-dependent differences of SUVmax values were observed. The tumour differentiation is significantly correlated with SUVmax, tumour size, grading, gender as well as the expression levels for p53 and ERCC1. Furthermore, the expression level of p53 is significantly correlated with SUVmax and grading. The FDG-PET SUVmax is also significantly correlated with cancer differentiation. Furthermore, multiple stepwise regression analysis revealed that p53 expression was the primary predictor for SUVmax.
Conclusion: The current study suggests that SUVmax of primary tumour on FDG-PET might be a simple and good non-invasive method for predicting p53-related chemotherapy resistance in NSCLC.

B-0822 10:48

Integrated PET-CT in patients with non-small cell lung carcinoma: evaluation of equivocal mediastinal lymph nodes
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Purpose: The aim of this study was to identify radiological factors that may reduce false-positive results and increase diagnostic accuracy when staging the mediastinum of patients with non-small cell lung carcinoma (NSCLC).
Methods and Materials: This was a retrospective, interdisciplinary, per-node analysis study. We included patients with NSCLC and mediastinal nodes with an SUV max in the range of 2.5 to 4.0 kBq/ml on PET-CT. We hypothesised that the greatest number of false positive cases would occur in this cohort of patients.
Results: A total of 92 mediastinal lymph nodes were analysed in 44 patients. Mediastinal disease (N2/N3) was histologically confirmed in 15 of 44 patients and in 34 of 92 lymph nodes; positive predictive value of 37% and false positive rate of 63%. Node SUV max, tumour size, ratio of node SUV max to tumour SUV max (SUV node/tumour), and ratio of node SUV max to node size (SUV node/size) were significantly higher in true positive cases. Using a threshold of 0.3 for SUV node/tumour and 3 for SUV node/size yielded sensitivities of 91% and 71% and specificities of 71% and 69%, respectively, for the detection of mediastinal disease. Using both ratios in combination resulted in a sensitivity of 65% and a specificity of 88%. Concurrent benign lung disease was observed significantly more frequently in false-positive cases.
Conclusion: SUV node/tumor and SUV node/size may be complimentary to conventional visual interpretation and SUV max measurement in the assessment of mediastinal disease in patients with NSCLC.

B-0823 10:57

FDG PET-CT staging of breast cancer in young women
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Purpose: To assess the impact of FDG PET-CT staging in female breast cancer patients under the age of 40.
Methods and Materials: In this IRB waived retrospective study, we screened our Hospital Information System (HIS) for breast cancer patients < 40 years of age who underwent staging PET-CT prior to any treatment at our instititution between 2003 and 2012. To minimise selection bias, patients with symptoms or conventional imaging findings suspicious for extra-axillary nodal or distant

metastases, and patients with prior malignancy were excluded. Metastases found on PET-CT were confirmed by pathology in the majority of cases or by follow-up imaging. Initial clinical stage was based on physical exam, mammography, ultrasound and breast MRI. Relevant upstaging was defined as PET-CT stage greater than initial clinical stage and higher than stage II. In addition, incidental synchronous malignancies were recorded.
Results: Of 399 women identified in our HIS search, 134 met the inclusion criteria. PET-CT findings lead to relevant upstaging in 27 patients (20%), including 1 of 20 (5%) with initial clinical stage I, 18 of 92 (20%) patients with initial stage II, and 8 of 22 (36%) patients with initial stage III. Additionally, 4 thyroid and 1 rectal synchronous malignancies were found.
Conclusion: FDG PET-CT upstaged 20% of women < 40 years of age. Although, current NCCN breast cancer guidelines include FDG PET-CT only for stage III patients, these data suggest that women < 40 may benefit from PET-CT staging even at stage II. A prospective study should verify these findings.

B-0824 11:06

Imaging of prostate cancer biological relapse: our experience of MRI and PET-CT comparison in the evaluation of bone and lymphnode metastases and in detection of local recurrency

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Purpose: Our aim was to compare the accuracy of 18 F-Choline PET-CT versus MRI in the diagnosis of local recurrency, bone and lymphnode metastases in prostate cancer. Appropriate imaging improves therapy and follow-up in malignant recurrency and can lead radiation therapy (RT).
Methods and Materials: We selected 32 patients reporting post-surgery and post-radiotherapy increased PSA serum levels who had undergone both 18 F-Choline PET-CT and T2W HR, DWI and DCE perfusional MRI.
Results: 18 F-Choline PET-CT and MRI showed up prostate cancer local recurrency in the same 22 patients. PET-CT showed up 8 suspicious lymphnodes in 4 patients whereas MRI revealed 30 lymph nodes -mostly false positive- in 16 patients (including those reported by the PET-CT). True positive PET-CT lymph nodes were confirmed by PSA serum value < 0.1 ng/ml one year after RT. Regarding bone metastases, PET-CT showed up 18 F-Choline bone uptake in 80 areas suspicious for malignancy (mostly in the vertebrae) in 16 patients with a SUV borderline value. Among all the 80 areas showed up by the PET-CT only 12 (in 8 patients) were confirmed by MRI.
Conclusion: PET-CT and MRI appeared to be equally accurate in revealing prostate cancer local recurrency. PET is much more specific in the evaluation of lymphnode metastases. In recognising bone metastases, PET-CT revealed high sensitivity but low specificity (owing to the borderline SUV levels) whereas MRI is more sensitive and specific. Therefore PET-CT an MRI image integration seems to be the best choice in making more accurate diagnosis and re-staging.

B-0825 11:15

The nature of incidental colonic FDG uptake at PET/CT

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Purpose: To investigate the nature of incidental colonic focal FDG uptakes and that of simultaneous lesions detected at colonoscopy but missed at PET/CT.
Methods and Materials: Among 9,073 patients scanned at PET/CT between September 2008 and July 2012, 82 without history of colonic disease had focal colonic uptakes and subsequent colonoscopy. Reading in consensus these PET/CT examinations, a radiologist and a nuclear physician recorded the location of uptakes and CT abnormalities, measured standardised uptake value (SUV) and metabolic volume (MV), firstly not informed and secondly informed about lesion location at colonoscopy. Records and measurements were compared between histological types (benign, premalignant, or malignant) of lesions detected at colonoscopy. ANOVA, logistic regression, t-test, and Pearson's test were used.
Results: 107 uptakes at PET/CT and 150 lesions at colonoscopy were detected. Among 107 uptakes, 65 (61%) corresponded to a lesion at colonoscopy (true positive) while 42 (39%) did not (false positive). Among 150 lesions at colonoscopy, 85 (57%) were non FDG-avid (false negative). MV of true positive uptakes was lower than that of false positive ones (4.0 ± 0.4 cm^3 *vs.* 6.16 ± 0.7 cm^3; p=0.006), but their SUVmax were not significantly different (7.4 ± 0.5 *vs.* 7.7 ± 0.5; p=0.649). MV was the only variable predictive of a lesion at colonoscopy (p=0.018). There was no difference in SUVmax or MV between benign, premalignant, and malignant lesions (p ranging from 0.184 to 0.601).
Conclusion: Focal uptake can correspond to any histological type of colonic lesions. Their detection should be followed by colonoscopy not restricted to the zone housing the uptake.

B-0826 11:24

Assessment of recurrent peritoneal carcinomatosis with 18 F-FDG-PET/CT in patients after cytoreductive surgery and hyperthermic intraperitoneal chemotherapy

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Purpose: In patients with peritoneal carcinomatosis (PC), cytoreductive surgery with hyperthermic intraperitoneal chemotherapy (HIPEC) is an approach with curative intention. Differentiation between posttherapeutic findings and relapse of PC is challenging. We evaluated 18 F-FDG-PET/CT in the follow-up to detect relapse of PC after HIPEC.
Methods and Materials: 36 patients with recurring PC after HIPEC were included (44 examinations). The examination included 3D 18 F-FDG-PET and contrast enhanced CT. Images were assessed by two experienced readers regarding the presence and the extent of PC using the peritoneal carcinomatosis index (PCI). Imaging results were correlated with surgical findings or follow-up.
Results: Relapse was suspected in 40 of 44 18 F-FDG-PET/CT examinations 341 ± 269 days after HIPEC. PC was suspected in 237 of 572 peritoneal segments. Relapse was missed by 18 F-FDG PET/CT in 4 patients and significantly underestimated in 8 patients. Diagnostic accuracy for the detection of PC on patient base was 91%, sensitivity 91% and positive predictive value 100%. The correlation of imaging and surgical findings on segmental base regarding the extent of PC was moderate (r=0.624). The mean PCI found by PET/CT was 11.4 ± 11.9 and by surgical exploration 16.6 ± 15.0. The extent of PC was systematically underestimated by PET/CT ($p < 0.05$).
Conclusion: The diagnostic value of 18 F-FDG PET/CT after cytoreductive surgery and HIPEC in the detection of recurring PC is good. However the quantification of the extent of PC is limited due to post therapeutic tissue alterations.

B-0827 11:33

The influence of 18 F-FDG PET/CT on therapy management of patients with malignant melanoma stage III/IV: survival analysis after 5 years of follow-up

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Purpose: To evaluate the influence of 18 F-FDG-PET/CT on therapy management and outcome of patients with stage III/IV melanoma.
Methods and Materials: Patient-based re-evaluation of CT and 18 F-FDG-PET/CT scans of 64 patients with advanced, primarily examined by a lesion-based analysis (Pfannenberg et al. 2007). The cohort included 52 primary and 12 restaging examinations. For each patient, it was analysed if PET/CT caused a change in therapy in comparison to the decisions based on CT alone. Therapy modifications were classified in "major" (surgical vs. systemic therapy) and "minor" (1^{st} line to 2^{nd} line chemotherapy). Patient's follow-up was documented and 5-year survival rates were calculated.
Results: PET/CT resulted in a change of therapy in 54% of patients of the entire group including "major" changes in 45%. PET/CT excluded distant metastases in 8/64 patients primarily planned for metastasectomy based on CT-scan. The highest number of shifts (59%) occurred in patients for primary staging consisting of 52% major changes. The corresponding data for the restaging group were 33% therapy changes (4/12 patients), thereof two patients with a major shift. In 11/27 patients already scheduled for surgery PET/CT revealed further metastases, making an operation futile. The 5-year survival rate of the entire cohort was 30.1% with an increase to 33.6% in primary staging and a reduction to 16.7% in restaging group.
Conclusion: FDG-PET/CT significantly influences therapy decisions in patients with stage III/IV melanoma, especially for the proper selection for complete metastasectomy, thereby increasing the long-time survival of this patient group.

B-0828 11:42

18 F-FDG PET/CT for characterisation of peripheral nerve sheath tumours in patients with neurofibromatosis type 1: intratumoral heterogenity of tracer uptake as new parameter

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Purpose: The aim of this study was to evaluate the usefulness of intratumoural tracer uptake heterogeneity on 18 F-fluorodeoxyglucose (FDG) PET/CT as compared to a cut-off SUV_{max} for characterisation of peripheral nerve sheath tumours (PNSTs) in patients with neurofibromatosis type 1 (NF1). PNSTs may undergo focal malignant transformation. Heterogeneity of tumour composition is known a histopathological hallmark of malignant change. Malignant peripheral nerve sheath tumours (MPNSTs) usually demonstrate increased and inhomogenous tracer uptake.

Methods and Materials: 50 patients with NF1 underwent ^{18}F-FDG PET/CT. Intralesional ^{18}F-FDG uptake was analysed by measuring the mean and maximum standardised uptake value (SUV). Heterogeneity of tracer uptake was evaluated using a SUV-based heterogeneity index (HI_{SUV}) and qualitatively graded using a three-point scale. Histopathologic evaluation as well as clinical and radiological follow-up served as reference standard.
Results: Both, HI_{SUV} and SUV_{max} could identify malignant tumours with a sensitivity of 100%. Qualitative intratumoural uptake heterogeneity and malignant transformation in peripheral nerve sheath tumours showed a significant association ($p < 0.0001$). MPNST showed a significantly larger HI_{SUV} compared to benign tumours (p=0.0002). Cohen`s κ was 0.86 for interrater agreement and 0.88 for intrarater agreement on heterogeneity.
Conclusion: MPNSTs in patients with NF1 reveal strong intratumoural heterogeneity of tracer uptake in 18 F-FDG PET/CT. Either a SUVmax cut-off value or a heterogeneity index can identify malignant PNSTs with a sensitivity of 100%. The SUV_{max} approach using a cut-off value leads to a higher specificity. There is no significant improvement in diagnostic performance using both methods in combination.

B-0829 11:51

The value of F18-FDG PET/CT in the diagnosis of CUP syndrome: a retrospective study

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Purpose: Metastatic cancer without a primary site is known as cancer of unknown primary (CUP Syndrome). We distinguish between head/neck tumours (mostly squamous) and tumours of the whole body (usually adenocarcinomas). The life expectancy of these patients may increase by proper identification of the original tumour and consequent adapted therapy. The aim of this analysis is to show the value of F18-FDG PET/CT in the diagnosis of primary tumours in comparison to conventional diagnostics based on the database of Praxis in KölnTriangle, Germany.
Methods and Materials: Between 2008 and 2013 out of a total of 2800 cases, we performed 134 F18-FDG PET/CTs for 116 patients (56 male/60 female, median age 61y). with CUP Syndrome. So far, 59 cases (44%) were tracked (medical letters, histology, therapeutic approach). Conventional diagnostics (CT, MRI, scintigraphy, panendoscopy) was primarily performed in almost all patients.
Results: We could identify a possible primary in 80 cases (59.7%), 70 cases additional to conventional diagnostics. In head/neck tumours, the primary was most commonly found in the nasopharynx and tonsils (34.6%, resp. 23.07%). Whole-body tumours were found mostly in the lungs (38.8%) and the gastrointestinal tract (20.37%). Unknown metastases have been identified in 50 cases (37.3%). For head/neck tumours, the examination-related sensitivity for the detection of primary tumours was 90% and the specificity was 85%. For whole-body tumours, these values were 93%, respectively 88%.
Conclusion: The F18-FDG PET/CT can identify additional primary tumours and metastases in 52% of cases when compared to conventional diagnostics and facilitate possible life-prolonging therapy.

10:30 - 12:00 **Room F2**

Breast

SS 1702

Breast density and general breast MRI

Moderators:
R.M. Pijnappel; Utrecht/NL
K. Pinker-Domenig; Vienna/AT

B-0830 10:30

Fully automated breast density measures and breast cancer risk: a case-control validation study

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Purpose: Legislation requiring reporting of breast density to women has been enacted and endorsed across the US. The current standard of care for breast density assessment is visual assessment by radiologists applying the American College of Radiology (ACR) BI-RADS density lexicon. However, the ACR has indicated that BI-RADS assessments are not reproducible and no longer endorses its use. Automated breast density measurement software provides such reproducible measures of density, but must be clinically validated.
Methods and Materials: A case-control study (n=1287), frequency matched (1:2) on 5-year age-group at screen, was conducted using data from the Nova Scotia Breast Screening Program and Capital District Health Authority (Nova Scotia, Canada). Logistic regression was used to model the association between mammographic density and breast cancer risk, controlling for age, first-degree family history of breast cancer, menopausal status, number of births and HRT use at time of screen. Percent density was measured from single digital MLO views using Densitas (Densitas Inc)., an automated mammographic density assessment software.
Results: Cases and controls were similar number of births, HRT use, menopausal status and family history. Controlling for these risk factors, women with ≥75% density had a significantly increased risk of breast cancer compared to women with ≤25% mammographic density [odds ratio 3.58 (1.7, 7.4)].
Conclusion: The results from this study show that breast density measured using Densitas' automated breast density software is similarly associated with breast cancer risk as visually assessed breast density measured by radiologists.
Author Disclosures:
M. Abdolell: Founder; Densitas Inc. Patent Holder; Densitas Inc. **K.M. Tsuruda:** Employee; Densitas Inc.

B-0831 10:39

Very low mammographic breast density predicts poorer outcome in patients with invasive breast cancer

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Purpose: To examine the prognostic value of mammographic breast density (MBD) and tumor features and their relationship with established prognostic factors in selected patients with invasive breast cancer.
Methods and Materials: This study is based on a database of 278 breast cancer patients treated in Kuopio University Hospital during 2002-2008. Altogether 139 consecutive HER2-positive breast cancer patients were first selected and subsequently complemented with HER2-negative patients (n=139) matched for age and time of operation. Mammograms were analysed in consensus by 5 radiologists to evaluate tumor features and MBD according to the Breast Imaging Reporting and Data System (BI-RADS). Breast density was dichotomized into Very Low Density (VLD; BI-RADS 1) or Mixed Density (MID; BI-RADS 2+3+4). Mammographic features were then compared with established prognostic factors and outcome of the patients.
Results: 50 deaths occurred during the follow-up time, of which 40 (14.4%) were from breast cancer. Patients with VLD breasts had a significantly worse prognosis compared to patients with MID breasts (disease free survival 75.6% vs. 90.7%, $p < 0.01$; and overall survival 75.5% vs. 90.2%, p=0.01). The association remained significant even after correcting for age (≤50 and > 50 years). No other mammographic feature was prognostically significant. In Cox regression analysis VLD proved to be an independent poor prognostic feature second only to HER2 positivity.
Conclusion: Previously, high breast density has been shown to be a significant risk factor for breast cancer. However Very Low Breast Density is associated with poorer outcome.

B-0832 10:48

Geographical variation in mammographic density distribution in the Netherlands

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Purpose: Mammographic density is related to screening sensitivity. Differences in breast density distribution between populations may thus explain part of the variation in regional screening performance. The aim of this study was to determine whether regional differences in breast density distribution are present in the Netherlands.
Methods and Materials: As part of the DENSE trial, density profiles of unprocessed mammograms were collected from screening units. The regions in our study were based on the geographical coverage of 13 radiology groups. In total, 149,167 screening examinations between 2012 and 2013 were included. Volumetric breast density was determined using the fully-automated software Volpara (Mātakina Technology, New Zealand). Three breast density measures were studied, namely: dense tissue volume (in cm3), percent density (in %), and the Volpara Density Grade (VDG; categories 1-4).
Results: The distribution did appear to vary between the regions. The highest density was observed in the middle of the country, with a geometric mean percent density of 7.86 (95%CI: 7.81-7.90) and 9.6% of the examinations classified as VDG4. In the lowest breast density region, the geometric mean percent density was 6.56 (95%CI: 6.44-6.69) and 6.3% of the exams were classified as VDG4. Preliminary analyses showed that the effect of age-adjustment was limited. Analyses on potentially explanatory variables like socio-economic status (SES) and breast cancer incidence will be presented at the conference.
Conclusion: The preliminary results suggest that geographical variation in mammographic density distribution is present in the Netherlands, which would support structural assessment of breast density within the screening programme.

Author Disclosures:
C.H. van Gils: Other; Principal investigator of the DENSE trial. Matakina has provided the Volpara software licenses for this trial. Bayer Health Care provides a financial contribution for the DENSE trial. **G.J. den Heeten:** Advisory Board; Former member of the medical advisory board of Matakina.

B-0833 10:57

Volumetric breast density: can computer assessment really reduce human variability?

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Purpose: To verify if breast density assessment computer-based can reduce inter-reader variability for women with dense breasts.
Methods and Materials: 2103 consecutive patients from a diagnostic population who underwent bilateral digital mammography in two views between Jan and Mar 2013 were included in the study. Volumetric breast density (VBD) calculated by Volpara 1.4.3 was compared with the BIRADS scores assessed by six breast radiologists independently. Inter-reader variability was evaluated using kappa statistics, and the subset of dense breasts (classified by each reader as BIRADS 3 and 4) was further analyse, comparing individual agreement/disagreement versus the majority of readers.
Results: The overall kappa across the readers was 0.56, associated to a moderate agreement. However, the mean absolute agreement between individual readers and the majority was 81.0%. In particular, cases for which the individual readers assigned a BIRADS 3 while the majority was 4 and vice versa, ranged from 3.1% to 8.7%, leading to a mean by 6.4%. Mean VBD for those cases was between 18.12% to 21.34% depending on the reader. The VBD distributions were overlapped with the distributions of VBD for cases of total agreement (either BIRADS 3 or 4) for 3 out of 6 readers, indicating that the threshold between BIRADS 3 and 4 is not the same across the readers.
Conclusion: Volumetric breast density computer-based can remove inter-reader variability in categorisation of dense breasts and following decisions about patient workup.

B-0834 11:06

Breast density percentage assessment using a 3 T MRI system: comparison amongst sequences using IDEAL (iterative decomposition of water and fat with echo asymmetry and least squares estimation) sequences as reference standard

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Purpose: There is no standardised method to evaluate breast density. IDEAL (iterative decomposition of water and fat with echo asymmetry and least squares estimation) sequences permit a differentiation of breast tissue composition on MRI. We used this sequence as a reference standard to compare breast density percentage evaluated on standard MRI sequences.
Methods and Materials: The study was approved by the Local Ethics Committee (National Institute for Cancer Research) and written informed consent was obtained from participating women. MRI examination was performed in 48 consecutive patients (mean age 41, years; range, 35-67 years) on a 3.0 T scanner with a dedicated eight-channel bilateral breast coil. MRI protocol included: T1-turbo spin-echo (T1-tSE), T2-turbo spin-echo (T2-tSE), IDEAL and VIBRANT (volume imaging for breast assessment) before and after injection of contrast media. Breast density was calculated with a semi-automated software. Statistical analysis was performed with non-parametric tests as appropriate.
Results: Mean percentage of breast density calculated in each sequence was: T1-tSE = 56%; T2-tSE = 52%; IDEAL Fat Only = 55%; IDEAL Water Only = 53.46%, VIBRANT = 54.85%. Significant differences were observed between T2-tSE and both T1-tSE ($p < 0.001$), VIBRANT sequences ($p = 0.009$), T1-tSE and both IDEAL Water Only ($p = 0.007$) and IDEAL Fat Only ($p = 0.047$). Breast density percentage showed a positive linear correlation amongst different sequences: $r \geq 0.93$.
Conclusion: Differences amongst MRI sequences used to assess breast density percentage exist. T1-weighted sequences showed the more similar breast density percentage values to IDEAL Water Only sequences used as reference standard.

B-0835 11:15

Visual and automated volumetric assessment of mammographic density (MD): do measurements depend on the digital mammography unit?

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Purpose: Full field digital mammography (FFDM) facilitates automated volumetric measurement of mammographic density (MD), a potent risk factor for breast cancer. It is unknown if there are systematic differences between MD measurements derived from mammograms acquired on different vendor units. This work aimed to assess this using a commercially available volumetric tool.
Methods and Materials: IRB approval was waived for this retrospective study of anonymised images. Mammograms from 100 subjects obtained on GE Senographe™ and Hologic Selenia™ units 1 year apart were studied. Percent volumetric density was measured with Volpara™. For comparison, two experienced observers with proven excellent intra- and inter-observer reliability visually assessed MD, blinded to manufacturer, using ACR BI-RADS scoring and a percentage scale. Agreement between paired scores was tested using intraclass correlation coefficients and Cohen's kappa.
Results: Agreement between paired scores was excellent for all methods (ICC/kappa all > 0.9, $p < 0.001$). For Volpara, mean absolute difference between paired scores was 0.67% (95% CI -0.17% - 1.16%), ~8% of the median Volpara score (8.4%). No systematic bias was identified. 10% of BIRADS paired scores disagreed and higher scores were assigned to Senographe mammograms in 85%. Visual percentage scores were statistically significantly higher for Senographe mammograms in 79% of cases (Chi2, $p < 0.001$).
Conclusion: Variances between volumetric MD measurements using Volpara™, obtained from GE Senographe and Hologic Selenia mammograms in the same women one year apart, were small and equally distributed in both directions, whereas human visual density scores were statistically significantly more likely to be higher in Senographe mammograms.

B-0836 11:24

Breast MRI and false negative invasive ductal carcinoma at our department

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Purpose: High sensitivity of MRI in breast cancer (BC) diagnosis is known to be supported by angiogenesis, which is responsible of the early uptake of gadolinium. The aim of this study was to analyse the inner architecture of some invasive carcinoma (IC) that didn't correspond to this semeiotic basis.
Methods and Materials: Between 2009 and 2012 we staged 194 BC, 4 of which not combined with contrast-uptake. Histology revealed IC, triple-negative status, grading3, proliferative index > 60%. We compared these 4 cases with 12 consecutive BC with the same biology but normally enhancing at MRI.
Results: Pathology revealed in all non-enhancing BC a common pattern of densely stuffed cells, with and an epithelial-stroma ratio prevalent for cells. For the non-enhancinc BC the cell number average was 120x10hpf (high-power-field), while in the normally-enhancing BC this average was 47xhpf ($p=0.0036$ Wilcoxon test).
Conclusion: False negative results due to the non-uptake of gadolinium are mainly described for in situ carcinoma. Non enhancement for IC is conversely very rare. Since the biodistribution of gadolinium foresees a transition from peripheral vessels into extracellular space, a possible explication of the low uptake can be related to a mechanic phenomenon given by the numerosity of the cells compared with the lack of the stroma. The clinical relevance of this phenomenon is that if gadolinium can't reach these neoplasm, even for chemotherapy it could be difficult to target them. For this subgroup of BC, MRI imaging can thus become a predictive indicator of the sensibility to some specific therapies.

B-0837 11:33

Differentation of ductal carcinoma in situ (DCIS) vs fibrocystic breast disease using breast MRI: new insights on imaging patterns and diagnostic accuracy

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Purpose: In breast-MRI one very frequent cause for false-positive DCIS diagnoses remains fibrocystic breast disease (FBD). Surprisingly, there is little systematic data on the characteristic imaging-patterns of FBD and its differentiation from DCIS. This breast-MRI study aims to identify typical appearances of both entities and to investigate accuracy for the differentiation of DCIS from FBD.
Methods and Materials: Consecutive patients receiving breast-MRI (standardised-protocols: dynamic-T1w-GRE before/after Gd-DTPA [0.1 mmol/kgBW]; T2w-TSE) with subsequent pathological-sampling were investigated. 16 previously published breast-MRI descriptors were prospectively assessed by two experienced radiologists in consensus (> 500 MRM-examinations; blinded to pathology). All patients showing DCIS (n=76) or FBD (n=219) were evaluated statistically: Univariate- and multivariate statistics were performed to identify accuracy of single descriptors, accuracy of descriptor-combinations, as well as overall-accuracy of breast-MRI for the differential-diagnosis of FBD vs. DCIS (χ^2-statistics; CHAID-tree: area-under-the-ROC-curve[AUC]; Bonferroni-correction).

Results: 5 (31%) breast-MRI descriptors significantly differentiated DCIS form FBD ($P_{corrected}$< 0.05). Highest accuracy was identified for "Wash-in" (Odds-ratio/OR=5.7), "Blooming-sign" (OR=3.4), "Wash-out" (OR=3.2) and "Adjacent-vessel-sign" (OR=3.0). Performance of single features could be improved, if multiple descriptors were applied in combination, e.g.: presence of "wash-in (weak)" & "oedema (absent or diffuse)" was highly typical of FBD (OR=22.8), whereas presence of "wash-in (intermediate or strong)", "shape (irregular)" and "blooming-sign" was characteristic of DCIS (OR=6.4). Overall accuracy of breast-MRI for the differential-diagnosis of DCIS vs. FBD revealed AUC=0.75 (cross-crossvalidated sample).
Conclusion: We identified typical breast-MRI features of DCIS and FBD. Such showed significant potential to differentiate both pathologic entities, particularly if they were used in combinations.

B-0838 11:42

Inflammatory breast disorders - benign vs malignant: does T2-weighted magnetic resonance sequence (MRI) meet this diagnostic challenge?
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Purpose: The purpose of the study is to assess the role of T2-weighted MRI sequence in discriminating benign from malignant inflammatory breast disorders.
Methods and Materials: The study included 90 patients presenting with signs of mastitis. They were subjected to MRI examinations. Lesions were classified as of bright, intermediate or of low signal intensity. The presence of collections and skin thickening were reported. Biopsy was performed. Pathology results were correlated with the postulated MRI diagnosis. Measures of diagnostic accuracy were then calculated.
Results: According to pathology reports, 60 (66.7%) cases were benign and 30 (33.3%) cases were malignant. Bright T2 signal correlated with benign pathologies (53/60, 88.3%) and dark T2 signal (26/30, 86.66%) correlated with malignant ones (P value=0.018). Presence of ill-defined collections (56/60, 93.3%) was significantly higher in benign cases (P value=0.001). A cut off value of skin thickness ≥5 mm was considered indicative of malignancy (area under ROC 0.668). The overall calculated sensitivity, specificity, PPV, NPV and efficacy of MRI based on the T2 WIs findings were 86.7%, 96.67%, 92.86%, 93.55% and 93.33%, respectively.
Conclusion: In this study, we verified the role of T2 WIs in differentiating between benign and malignant forms of mastitis. T2W MRI images should be incorporated in the diagnostic work up of mastitis patients especially in cases that are resistant to medical treatment. Bright T2 signal, ill-defined collections and mild skin thickening were considered indicative of benign lesions. Dark T2 signal, absence of collections and extensive skin thickening were considered as indicative of malignant lesions.

B-0839 11:51

A rim-enhanced mass with central cystic changes on MR imaging: how to distinguish breast cancer from inflammatory breast diseases?
L. Wang, D. Wang; *Shanghai/CN (wangjun.124@163.com)*

Purpose: To evaluate the capacity of magnetic resonance imaging (MRI) to distinguish breast cancer from inflammatory breast diseases manifesting a rim-enhanced mass with central cystic changes.
Methods and Materials: Forty cases of breast cancer and 52 of inflammatory breast diseases showing a rim-enhanced mass with central cystic changes were retrospectively reviewed. All cases underwent dynamic contrast-enhanced MRI and 31 of them underwent diffusion-weighted imaging (DWI). Morphological features, dynamic parameters and apparent diffusion coefficient (ADC) values were comparatively analysed using univariate analysis and binary logistic regression analysis.
Results: The mean age of breast cancer was older than that of the inflammatory disease group (55.4 years vs. 44.5 years, P < 0.001). Breast cancer had a significantly thicker wall than the inflammatory diseases (P < 0.001), while internal enhancing septa were more common in inflammatory diseases (P=0.003). On DWI, 86.7% of breast cancers showed a peripheral hyperintensity, whereas 93.8% of inflammatory breast diseases had a central hyperintensity (P < 0.001). Compared to the inflammatory diseases, breast cancers had a lower ADC value for the wall (1.02×10^{-3} mm^2/s vs. 1.45×10^{-3} mm^2/s, P=0.001) and a higher ADC value for the cavity (1.93×10^{-3} mm^2/s vs. 1.01×10-3 mm^2/s, P < 0.001).
Conclusion: Both breast cancer and inflammatory breast disease could present as a rim-enhanced mass with central cystic changes on MRI. Integrated analysis of the MR findings can allow for an accurate differential diagnosis.

10:30 - 12:00 **Room G/H**

Genitourinary

SS 1707

Imaging of the kidney: an update

Moderators:
M.-F. Bellin; Le Kremin-Bicêtre/FR
J.J. Fütterer; Nijmegen/NL

B-0840 10:30

Assessment of renal function with unilateral ureteral obstruction using 320-detector MDCT
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Purpose: To investigate the renal cortical and medullary perfusion changes associated with unilateral ureteral obstruction (UUO) using 320-detector MDCT.
Methods and Materials: This study included 64 patients with UUO. According to the hydronephrosis severity, they were divided into three groups: mild, moderate and severe group. The 320-detector row CT scanner enabled renal perfusion CT without table movement. Perfusion was calculated using the maximum slope and Patlak model. The mean cortex and medulla perfusion of healthy and diseased kidneys were compared.
Results: Mean cortical and medullary blood flow (BF), blood volume (BV) and clearance statistically decreased from the mild group to the moderate group to the severe group (p < 0.05). An inverse correlation was observed between cortical BV, BF, clearance, medullary clearance and hydronephosis severity (r=-0.270, p=0.004; r=-0.474, p=0.000; r=-0.515, p=0.004; r=-0.329,p=0.001, respectively). Compared to the healthy kidneys, the mean cortical BF, BV and clearance in the severe group were found to have a statistically significance (p < 0.05). The mean cortical and medullary BF, BV and clearance in the other two groups were lower than those in the normal group, but did not achieve statistical significance (p> 0.05).
Conclusion: 320-Detector MDCT makes it possible to conduct perfusion measurements of the whole kidney. Our preliminary results suggested that estimated perfusion values have the potential to be used for evaluation of UUO renal injury.

B-0841 10:39

Renal sinus fat invasion in renal cell carcinoma: evaluation of multidetector computer tomography (MDCT) predicting factors
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Purpose: To determine imaging factors of MDCT that are able to predict renal sinus fat invasion in patients with renal cell carcinoma (RCC).
Methods and Materials: A total of 113 patients (84 males, mean age 57.4±12 years) with RCC (91 clear cell, 15 chromophobe, 4 papillary, 2 collector duct, 1 translocation) who underwent multiphase contrast-enhanced 64-MDCT and partial or radical nephrectomy were included in this retrospective study. Detection of enhanced nodules in the renal sinus fat, maximum tumor dimensions, the ratio between intra- and extrarenal tumor diameter, the absence of a pseudo-capsule and vascular invasion were considered predictors of histologically confirmed renal sinus fat invasion.
Results: In multivariate logistic regression analysis, enhanced nodules, the ratio between intra- and extrarenal tumor diameter < 0.4 and vascular invasion were the only independent predictors of renal sinus fat invasion (p < 0.0001). The detection of an enhanced tumor nodule in renal sinus fat alone, is able to predict the invasion with an AUROC of 0.75 (Se=60%, Sp=91%). Adding the vascular invasion quantification and a ratio between intra- and extrarenal tumor diameter < 0.4, increases the diagnosis value to an AUROC=0.85 (Se=83%, Sp=81%), with 79.56% correctly classified patients according to histology reports.
Conclusion: Our data suggest that the detection of an enhanced nodule, together with vascular invasion and a ratio between intra- and extrarenal tumor diameter < 0.4 are better predictors of histologically confirmed renal sinus fat invasion than the presence of an enhanced tumor nodule alone.

B-0842 10:48

Estimation of postoperative renal function through virtually calculated renal cortical volume on CT in patients undergoing total nephrectomy

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Purpose: The purpose of our study was to estimate the postoperative renal function through the virtually calculated renal cortical volume measured by preoperative CT in patients undergoing total nephrectomy.
Methods and Materials: A total of 105 patients undergoing MDCT and total nephrectomy for kidney donation (n=65) or renal mass (n=40) were included in this study. The preoperative CT was assessed to measure the volume (cm^3) of both kidneys using the software that automatically contours the renal cortex. Estimated glomerular filtration rate (eGFR, ml/min/1.73m^2) was measured after operation. Statistical analysis was done using the linear mixed-effects models (MIXED) procedure in SPSS.
Results: Renal volume measurements yielded a mean virtual pre- and postoperative renal cortical volume of 254.2 and 125.6, respectively. Preoperative mean eGFR was 72.3, and postoperative eGFR was respectively 61.7, 71.4 and 69.3 at 6, 12 and 18 months after operation. The MIXED procedure revealed that the reason of operation (donation or tumor), gender, HTN, proteinuria, weight, age, virtual preoperative, postoperative, removed renal cortical volume and the time after operation correlate significantly with the eGFR. Especially, the reason of operation, virtual preoperative renal cortical volume and the time after operation are more important factors for predicting postoperative eGFR ($p < 0.001$).
Conclusion: Renal cortex volume measured on CT can allow the prediction of renal function. Postoperative eGFR may be estimated by the virtual renal cortical volume calculation.

B-0843 10:57

Renal transplantation: 3D quantification of perfusion defects using contrast enhanced ultrasound, and its clinical significance

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Purpose: Nearly 3000 renal transplants are performed annually in the UK, following which it is common practice to obtain a Tc-DTPA renogram to assess perfusion of the graft. Although this provides functional information, disadvantages include its use of ionising radiation coupled with low spatial resolution, whilst being both time consuming and costly. We suggest that contrast enhanced ultrasound (CEUS) would provide a quick, cost efficient, high resolution, accurate alternative.
Methods and Materials: 97 renal transplants underwent both CEUS and Tc-DTPA after surgery. Tc-DTPA was performed in the nuclear medicine department with a standard dose of 150mBq over at least 10 minutes of screening. CEUS consisted of 2.4 ml Sonovue IV contrast, with 60 seconds continuous capture and 3D acquisition. 3D CEUS was analysed using QLab software. Patient renal function was monitored for 3 months post-operatively.
Results: Tc-DTPA detected 9 perfusion defects of varying sizes. CEUS detected all of these plus an additional 14 defects not identified on Tc-DTPA. Further analysis comparing perfusion defect against serum creatinine and eGFR demonstrates a positive correlation between the presence and size of the defect and degree of subsequent renal dysfunction.
Conclusion: CEUS is an accurate examination for detecting renal transplant perfusion defects. Due to high spatial and temporal resolution, CEUS will identify a significant number of additional defects not seen on standard renogram imaging. With the quantification of these perfusion defects, valuable prognostic information can be obtained to predict the degree of subsequent renal dysfunction influencing future clinical decision making and informing functional expectation.

B-0844 11:06

Differentiation of small (< 4 cm) angiomyolipoma with minimal fat from non-clear cell renal cell carcinoma on biphasic MDCT

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Purpose: To evaluate quantitative biphasic MDCT features that differentiate between small AMLmf and NCCRCC, and to integrate them to develop a simple and easy diagnostic algorithm.
Methods and Materials: This study was IRB-approved; informed consent was waived. Biphasic MDCT images of pathologically proven AMLmfs (n= 24) and NCCRCCs (n = 55) of 79 patients were evaluated. Age, sex, size, long-to-short axis ratio (LSR), attenuation and enhancement degree in all phases, precontrast tumour-kidney attenuation difference (PTKAD) in Hounsfield units (HU) were compared with Chi-square analysis, independent-samples t-test, ROC curves. A criterion was formulated with classification and regression tree analysis (CART). Thereafter, CART-based algorithm was tested with additional interpretations from two radiologists. Intra- and inter-observer variability was analysed with Bland-Altman analysis.
Results: LSR was greater in AMLmf than NCCRCC ($p < 0.001$). AMLmf showed higher attenuation (all phases), CMP enhancement and washout than NCCRCC ($p \leq 0.001$). PTKAD was greater in AMLmf than NCCRCC ($p < 0.001$). ROC curve analysis yielded area under the curves of 0.936, 0.888, and 0.853 using PTKAD, precontrast attenuation, and LSR. CART-based algorithm (PTKAD > 7.5 HU, LSR > 1.23) predicted AMLmf with sensitivity, specificity, PPV, and NPV of 87.5%, 96.4%, 91.3%, and 94.6%. Mean intra-/inter-observer difference was -0.1 HU/0.03 and -1.0 HU/0.09 for PTKAD/LSR, respectively. These interpretations changed the final diagnosis in 1.3% (1/79) and 5.1% (4/79) patients for radiologists 1 and 2.
Conclusion: Biphasic MDCT was useful for differentiating AMLmf and NCCRCC. CART-based algorithm using PTKAD > 7.5 and LSR > 1.23 was simple and accurate in predicting AMLmf.

B-0845 11:15

Assessment of diffusion parameters of the kidney over the entire cardiac cycle using ECG-triggered, time-resolved diffusion-weighted imaging (DWI)

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Purpose: To assess changes in renal diffusion properties over the entire cardiac cycle using ECG-gated, time-resolved diffusion-weighted imaging (DWI).
Methods and Materials: 20 healthy volunteers (10 males, 10 females, 26.2 ± 7.2 years) were investigated on a 1.5 T MR scanner. Blood flow within the renal arteries was determined by ECG-gated phase contrast (PC) flow measurements. For time-resolved renal diffusion weighted imaging (DWI), an ECG-gated and respiratory-triggered coronal single-slice EPI-sequence was acquired at 14 defined time points over the cardiac cycle (20.70,120,.,620,720 ms after R-wave) using the following parameters: 4 b-values (0, 50, 100, 300 s/mm2), 3 directions, TR/TE =3000 ms/66 ms, FOV=400 mm2, MxP =192x192, slice thickness 6 mm. ROI measurements were performed and an ADC pulsatility index (PIADC) was defined as normalised maximal change in ADC values within the cardiac cycle (ADXmax/ADCmin).
Results: Minimal renal blood flow velocity was 16.9 ± 5.6 cm/s at the time-point of the R-wave raising to a maximum of 40.4 ± 10.6 cm/s about 142 ms after the R-wave ($p < 0.05$). Minimal mean ADC value was 2145 ± 107 x 10-6 mm²/s at the time-point of the R-wave and maximum mean ADC was 2766 ± 213 x 10-6 mm²/s 138 ms after the R-wave ($p < 0.05$). Mean ADC pulsatility index in the renal cortex was PIADC = 1.30 ± 0.06.
Conclusion: Renal ADC values exhibit pulsatile characteristics over the cardiac cycle, enabling calculation of an ADC pulsatility index. Further studies are required to determine the diagnostic value of the ADC pulsatility index in patients with renal pathologies.
Author Disclosures:
G. Antoch: Speaker; Siemens Medical Solutions, Bayer Healthcare, BTG.

B-0846 11:24

Diffusion-weighted magnetic resonance imaging of kidneys in healthy volunteers and living kidney donors

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Purpose: Despite promising reports on diffusion-weighted MRI in diagnostics of renal disease, the lack of normalised data on water diffusion parameters in kidneys impedes a comparison of results obtained in different centers. Our study was aimed into establishing the normal ADC values in healthy kidneys, comparing them with literature, and assessing the correlation between ADC values, creatinine blood level, and GFR.
Methods and Materials: 24 healthy volunteers and 26 living kidney donors were examined on a 1.5 unit (Ingenia, Philips, The Netherlands). Two DWI sequences were included in the study protocol (sequence I-16 b values, sequence II- 10 b values). Before examination blood and urine samples were collected. GFR was calculated with Cockcroft&Gault and MDRD (Modification of Diet In Renal Disease) formulas and the ADC values were measured separately for the cortex and medulla of each kidney by two independent observers. All statistical analyses were performed using the STATISTICA (version 10.0) software package. Data were analysed using an unpaired t test; p-value< 0.05 indicated a statistically significant difference.
Results: The average ADC value for sequence I for the cortex was 2.26x10-3 mm2/sec, for the medulla 2.21x10-3 mm2/sec. In protocol II, the respective values were 2.13x10-3 mm2/sec and 2.06x10-3 mm2/sec. Neither statistically significant interobserver differences nor correlation between ADC values, GFR, and creatinine serum level were observed.
Conclusion: The average ADC values were established. The measurements show high interobserver consistency. The differences in reported ADC values suggest dependence on the equipment and methodology and point to the necessity of obtaining ADC norms for each MR unit.

B-0847 11:33

The role of MR perfusion in evaluating polycystic kidney disease: correlation with laboratory data (creatinine clearance)

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Purpose: To compare MRI perfusion technique with laboratory data (creatinine clearance) in patients affected by polycystic kidney, in order to develop useful MRI patterns to monitor the progression of the disease.
Methods and Materials: 47 patients with polycystic kidney in various stages of the disease underwent MRI examination with a 3 T magnet (GE Discovery MR 750) with multi-channel surface coil. For each patient first we evaluated the morphological pattern by using T2 and T1 imaging, then we assessed the vascularisation degree of the residual healthy renal parenchyma. Vascularisation data were collected using a T1-weighted GRE perfusion sequences acquired during intravenous administration of contrast medium perfusion volume (PV). MRI patterns were correlated with laboratory data.
Results: A statistically significant correlation ($P < 0.05$) between PV of both kidneys and creatinine clearance (CC) was found in all patients. A PV between 750 and 500 cm3 was correlated to a CC between 90 and 60 mL/min; a PV between 500 and 200 cm3 corresponded to a CC between 60 and 30 mL/min and a PV < of 200 cm3 corresponded to a CC < 30 mL7 min.
Conclusion: Functional MRI perfusion technique may be considered a valuable tool for assessing the progression of polycystic kidney disease.

B-0848 11:42

Renal artery anomalies associated with horseshoe kidneys: value of CT angiography

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Purpose: Arterial blood supply in patients with horseshoe kidney (HSK) is abnormal in about 75% and troublesome on surgery such as aortic aneurysm. We evaluated incidence of surplus renal arteries in HSK patients focused on numbers and diameters using CT angiography (CTA).
Methods and Materials: Thirty-two patients with HSK and 83 patients with normal kidney (NK) underwent CT angiography (CTA) using 64 MDCT. Based on 2D CT including MPR, MIP and volume-rendered images with 0.5 mm reconstruction interval on CTA, we assessed incidence of surplus renal arteries and those of greater than 3 mm in diameter and compared incidences of those between HSK and NK patients using Chi-square test.
Results: Total 320 arteries were identified (HSK: 117, NK: 203). Mean numbers of renal arteries were 3.66 ±1.1 in HSK patients and 2.45 ±0.7 in NK patients. The incidence of patients with surplus renal arteries was 90.6% in HSK patients and 33.7 % in NK patients. The incidence of patients with surplus arteries greater than 3 mm in diameter was 68.7% in HSK patients and 8.4% in NK patients. There was a significantly higher incidence of surplus renal arteries and surplus arteries of greater than 3 mm in diameter in patients with HSK than in NK patients on CTA (p=0.0029, 1.8E-6).
Conclusion: The incidences of large and surplus renal arteries were frequently found in HSK patients. Evaluation of renal artery anomalies of HSK using CTA may provide useful information for surgical managements and interventional treatments.

B-0849 11:51

Dose-optimisation of dual-source, dual-energy CT for urinary calculi: assessment of the image quality and radiation dose

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Purpose: To assess the image quality and radiation dose in dose-optimised, dual-energy CT (DECT) for suspected renal stones.
Methods and Materials: 75 patients who underwent unenhanced CT (SOMATOM Definition Flash, Siemens) for urinary calculi were divided into three groups of 25 patients each. In group A, DECT acquisition was performed with the standard protocol (tube-A, 100 kVp, 210 reference mAs; tube-B, 140 kVp, 162 reference mAs); in group B a low-dose single-energy CT (100 kVp, 100 reference mAs) was performed, followed, in case of stone-depiction, by standard DECT acquisition targeted to the stones; group C received a dose-optimised DECT protocol (tube-A, 100 kVp, 90 reference mAs; tube-B, 140 kVp, 70 reference mAs), previously assessed in a phantom study. The radiation dose was assessed with the dose-length product (DLP). The image noise and the CNR were calculated. Subjective image quality was analysed by three independent radiologists.
Results: Mean DLP in groups B and C (186.7 mGycm±59.6 and 219.4 mGycm±57.3, respectively; P=0.39) were significantly lower compared with group A (443.5 mGycm±107.6) ($P < 0.001$). Image noise was similar in groups B and C (8.9 HU±2.6 and 9.5 HU±3.2, respectively; P=0.65), but significantly higher than in group A (5.9 HU±1.7) ($P < 0.001$). The CNR was significantly higher in group A (27.6±6.6) compared to groups B and C (18.7±5.6 and 17.4±5.3, respectively; P=0.7) ($P < 0.001$). In the subjective analysis, the mean diagnostic image quality was rated as good or better for all groups.
Conclusion: Compared to a low-dose, single-energy protocol, the radiation dose of the standard DECT protocol, can be substantially lowered without compromising objective and subjective image quality.

10:30 - 12:00 **Room I/K**

Neuro

SS 1711

Resting-state and task-based fMRI

Moderators:
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B-0850 10:30

Resting-state and stimulus induced fMRI data fusion

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Purpose: Contrary to stimulus induced fMRI, resting-state fMRI captures spontaneous modulations in the blood oxygen level dependent signal during a resting condition. Resting-state fMRI offers insight in the brains' intrinsic connectivity architecture, and has clinical relevance. However, the relationship to task dependent networks is not yet fully understood. In this work the joint analysis of resting-state and stimulus induced fMRI data is evaluated.
Methods and Materials: The dataset consisted of 22 subjects from the NKI-RS - Multiband Imaging Test-Retest Pilot Dataset, published as part of the 1000 Functional Connectomes Project, with data acquisitions from a resting-state condition and a visual checkerboard stimulus available for each subject. Multiple Relational Embedding was used to establish a single joint embedding space encoding the functional connectivity structures of the resting-state and the visual checkerboard data. Functional registration followed by clustering was used to delineate similar network structures across the group. Cluster stabilities were quantified and compared to resting-state analysis without using information about the visual stimulus and to concatenated time-series.
Results: The results show that the additional visual stimulus data causes a stable split of the visual networks into two sub networks. Interestingly, the additional visual stimulus causes also a more stable delineation of basic resting-state networks, e.g. the default mode network. Additionally, it offers higher cluster resolution, i.e. we can differentiate smaller clusters while the cluster stability remains high.
Conclusion: The presented work shows that additional stimulus data can facilitate resting-state analysis, it can increase the network resolution in specific functional regions.

B-0851 10:39

Evaluation of multiparametric quantitative bold approach and cerebrovascular reserve in patients with severe intracranial arterial stenosis: a comparison study

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Purpose: To better characterise perfusion and oxygen metabolism disorders in patients with severe intracranial arterial stenosis (SIAS), we studied basal and functional changes of perfusion using functional MRI of cerebral vasoreactivity (CVR fMRI) with oxygenation measurement using a multiparametric qBOLD approach.
Methods and Materials: Eleven patients (2 females; 65.6±15.2yo) with SIAS of the internal carotid artery (n=5), middle cerebral artery (MCA) (n=6) were studied. Basal perfusion was measured using dynamic susceptibility contrast with deconvolution of the arterial input function to calculate conventional parameters (CBF, CBV, MTT, Tmax). BOLD CVR fMRI was acquired with a block-design hypercapnic challenge (8% CO_2). Average end-tidal CO_2 pressure ($EtCO_2$) was used as a physiological regressor for statistical analyses (SPM8). StO2 maps were obtained from a combination of CBV and T2' (1/T2'=1/T2*-1/T2). Cerebral metabolic rate of oxygen (CMRO2) map was computed using CMRO2=CBF.(1-StO2/100). Regions of interest (ROI) were drawn onto the segmented gray matter of vascular territories of the MCA to record basal perfusion CVR (ΔBOLD/mmHg $EtCO_2$) and CMRO2. For each parameter, we calculated laterality indices with LIMCA=(LeftMCA-RightMCA)/(LeftMCA + RightMCA).
Results: No adverse reaction to the protocol was reported. In the MCA territory ipsilateral to SIAS, basal perfusion (CBF, Tmax), CVR, and CMRO2 were impaired. Interhemispheric CMRO2 impairments expressed using LIMCA were

correlated with CBF (R=0.96, $p < 0.001$), MTT (R=-0.85, $p < 0.001$), and CVR (R=0.92 $p < 0.001$).
Conclusion: In patients with SIAS, basal and functional hemodynamic disorders are associated with a decreased oxygen metabolism, suggesting a low-grade chronic ischemia.

B-0852 10:48

Effects of refractive errors on functional magnetic resonance imaging of visual cortex

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Purpose: The purpose of our study is to evaluate the effects of refractive errors on functional magnetic resonance imaging of visual cortex
Methods and Materials: We performed a prospective study that included 13 patients with refractive error (group 1) and 30 emetropic volunteers (group 2). Group 2 was also subgrouped as 20-32 years old (young) and over 45 years old (old) to analyse presbyopia and accomodation effect. fMRI data were acquired with a block design pradigm with 3 Tesla MRI. In both groups, BOLD data initially was acquired in normal refractive state. fMRI was performed again in group 1 without their glasses/lenses and in group 2 with induced-myopia via +2D and +4D lenses. BOLD activation areas on visual cortex were calculated as square centimetre area in another workstation. Total activated area on visual cortex was compared between normal refractive state and induced/uncorrected refractive error.
Results: In group 1, fMRI data during uncorrected refractive error revealed significantly decreased activation areas compared with corrected refractive error (p=0.001). In group 2, induced-myopia resulted significant decrease compared with normal refractive state. Decrease in activation areas was significant both in 2D (p=0.003) and 4D ($p < 0.001$) myopia compared with normal refractive state. Both in young and old group, activation areas were significantly decreased during induced-myopia. We revealed no difference between young and old groups.
Conclusion: fMRI is a useful method to facilitate function preserving surgery in patients with brain tumour and epilepsy. Because the refractive errors affect the visual fMRI activations, they should be corrected in all refractive states.

B-0853 10:57

Functional connectivity of the subthalamic nucleus changes with age

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Purpose: The subthalamic nucleus (STN) plays a major role in motor control (which is known to decline with age), but also in emotionally and cognitive processing. The aim of this study was to detect age-related functional connectivity (FC) changes of the STN with resting state imaging (RSI).
Methods and Materials: 361 healthy adults (mean age 41.8 years) had RSI scans (> 8.5 min) at three different sites. The bilateral STN seeds were derived from 7-Tesla high-resolution susceptibility mapping. Confound removal (motion; mean tissue class-related signals) and band-pass filtering (0.01-0.08 Hz) was applied. Activity in the STN seed regions was represented by the first eigenvariate of the respective voxels' time-series and then correlated with the time-series of all other voxels in the brain. Age was used as a covariate in the analysis to identify regions with age-related changes of FC ($p < 0.05$, corrected for multiple comparisons at cluster level).
Results: An age-related decline of FC with STN was found for caudate nucleus, thalamus (all right), for bilateral posterior insula and vermis, while a decrease with age was found for bilateral sensorimotor cortex and bilateral putamen.
Age-related decrease in functional anticorrelations with STN was detected for left precuneus and left posterior cingulate cortex.
Conclusion: Changes in positive FC might provide a neural substrate for degradation of motor performance. On the other side, the reduced uncoupling of anticorrelated brain areas (like the precuneus, which is known to be involved in introspection) might indicate an increased interference from irrelevant cognitive processing in advanced age.

B-0854 11:06

Regional cerebral changes and functional connectivity during the observation of negative emotional stimuli in earthquake survivors with post-traumatic stress disorder in l'Aquila

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Purpose: Patients with PTSD exhibit exaggerated brain responses to emotionally negative stimuli, which normally activate the limbic system. Identifying the neural correlates of emotion regulation in these subjects is important for elucidate the neural circuitry involved in emotional dysfunction. To investigate the functional connectivity between the areas activated during emotional processing of negative stimuli in a sample of PTSD compared to healthy subjects.
Methods and Materials: Ten PTSD subjects (survived the 6.3magnitude earthquake on April 6.2009 in L'Aquila) (DSM-IV-R, APA 2000) and ten healthy controls underwent fMRI (GE 1.5 T), during observation of 80 images (40 negative emotional stimuli and 40 scrambled neutral stimuli). Clinical and neuropsychological assessment was administered to all subjects with PTSD. Statistical data analysis were performed using Brain Voyager QX4.6.
Results: A higher activation was found in the left posterior (LP) insula for PTSD group, and in the ventromedial prefrontal cortex (vmPFC) for the healthy group. Two sets of Granger causality modeling (GCM) analyses were performed, to examine the directed influences to other brain regions from LP-insula and vmPFC, identified individually for each PTSD and healthy subject respectively. Activity in the vmPFC in the healthy group while observing negative emotional stimuli predicted activity in several subcortical regions and insula.
Conclusion: The activation of the fronto-limbic network in healthy but not in PTSD suggests a lack of mediation and cortical control of emotional processes in these patients. This pattern of directed influence can be interpreted as the neural correlate of emotional control.

B-0855 11:15

Altered functional connectivity of the marginal division in medication overuse headache using resting state fMRI

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Purpose: To investigate the functional connectivity changes of the marginal division (MrD) in the patients with medication overuse headache (MOH).
Methods and Materials: Conventional MRI, 3D structure images and resting-state functional MRI (rs-fMRI) were performed in 21 patients with MOH and 21 matched normal control subjects. MrD was defined using manual drawing on structure images, and was applied to the computation of functional connectivity (FC) maps. Two-samples *t*-tests were performed on the individual FC maps the comparison of FC of MrD between two groups.
Results: Compared with normal controls, the increased functional connectivity of left MrD was demonstrated in left inferior temporal gyrus, right anterior and middle cingulate gyri for the patients with MOH. The increased right MrD connectivity was gathered in the left inferior temporal gyrus and frontal orbital gyrus, and right anterior cingulate gyrus. No decreased functional connectivity was detected.
Conclusion: The results of increased functional connectivity of bilateral MrD may support that MrD play a key role in the pathogenesis of MOH, and our findings also suggest that the characteristics of MrD connectivity could plausibly provide an early imaging biomarker for the diagnositc and evaluation of MOH.

B-0856 11:24

Effect of mindfulness meditation on BCI performance: a fMRI study

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Purpose: To observe the functional changes in brain activity while performing real and imagery movement using functional MRI (fMRI). To compare the fMRI changes of motor imagery before and after mindfulness meditation (MM) training and correlate this with actual brain computer interface (BCI) performance.
Methods and Materials: Eight right handed healthy volunteers were recruited to participate the EEG brain mapping, BCI performance test and fMRI of real and imagery movement of right hand (RH), left hand (LH) and both feet (BF). They were then randomly assigned into control and intervention groups. The intervention group received 12 hours of MM training. EEG brain mapping, BCI performance test and fMRI scanning were repeated after intervention. Statistical parametric mapping software was used for post processing and analysis of fMRI data.
Results: fMRI groups results showed activation of motor imagery of RH, LH and BF at premotor, prefrontal and visual cortices before MM training ($p < 0.05$, FWE). After MM training, fMRI results revealed more focus of activation in 3 out of 4 of the trained subjects on RH motor imagery, 2 out of 4 of the trained subjects on LH and BF motor imagery, comparing with the control group. This is also correlated with the improvement of BCI accuracy of the intervention group after MM training.
Conclusion: Mindfulness meditation improves BCI performance and is associated with more focus of functional changes in cerebral cortex on motor imagery.

B-0857 11:33

Charting the emergence of the foetal functional brain connectome in the thalamus and subplate: an in utero fMRI study

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Purpose: Endeavours to optimise prenatal MRI have opened the way for the utilisation of functional MRI in neurodevelopmental studies. We introduce an image processing and evaluation approach for the exploration of recurrent, developing patterns of fMRI signal fluctuations of the foetal brain.
Methods and Materials: MRI was indicated to exclude or confirm sonographically suspected abnormalities; after removing cases with motion-related artefacts, images of 32 foetuses were analysed (gestational weeks: 21-37). In utero functional brain MRI was performed using a gradient-recalled echo-planar sequence on a 1.5 T scanner. Slices were acquired perpendicular to the brainstem, each comprising 50 time points (TE/TR: 50/1000 ms). Analysis included motion and nuisance signal correction approaches; correlations of regional time courses were evaluated after transforming brains to gestational week specific templates. ROIs of the thalamus and subplate gross subdivisions were propagated through a temporal model of morphological development and connectivity matrices were provided.
Results: Spectral coherence tests revealed synchronicity of fMRI time courses within the subplate and thalamus in the 0.01-0.2 Hz frequency range. The strength of thalamus-subplate interconnections remained strong in the observed developmental phase ($R > 0.5$), whilst the regional subplate connectivity showed increased inter-hemispheric correlations with a marked shift from the 28th week. We were unable to reveal long-range intra-hemispheric connections in the mid- and late-foetal period.
Conclusion: In the mid-foetal period, brain activity can be characterised by spontaneous, low-frequency signal fluctuations predominantly located within the subplate. We suggest this in vivo technique for the refinement and elucidation of models on the emerging human brain functioning.

B-0858 11:42

Alterations of the regional cerebral metabolism and dysfunction of the resting state default mode network (RS DMN) in patients with Parkinson's disease (PD) and different level of cognitive impairment (CI): ^{1}H MRS and fMRI study

Z.Z. Rozhkova, O.M. Omelchenko; *Kiev/UA (invivo@ukr.net)*

Purpose: To investigate local metabolic state and integrity of RS DMN connectivity in patients with PD and different level of CI.
Methods and Materials: Three groups of PD-patients (57-73y) with various cognitive statuses are studied by fMRI, ^{1}H MRS with 1.5 TSIGNAEXCITE (GE). The 1st group (DPDG) consists of 13 PD-patients with dementia (MMSE< 25), 2nd (CIPDG)-15 PD-patients with mild CI (30>MMSE≥25), 3rd (NPDG)-12 PD-patients with normal cognitive function (MMSE> 30). Spectra are recorded in the white matter of the anterior (APCG), and in the posterior portion of cingulate gyrus (PPCG): SVSSTEAM (TR/TE=1500/144 ms). EPIBOLD scans were acquired with: TR/TE=3000/71 ms. ICA analysis was used to identify 20 networks of RS-activity, MELODIC (FSL).
Results: In APCG, the values of NAA/Cr in DPDG, CIPDG, NPDG are:(1.68+-0.02),(2.04+-0.03),(2.32+-0.05), Cho/Cr:(0.84+-0.02),(0.81+-0.05),(0.53+-0.03). In PPCG values NAA/Cr in DPDG, CIPDG, NPDG are: (1.14+-0.12), (1.81+-0.02), (1.98+-0.04), Cho/Cr: (0.96+-0.02), (0.77+-0.03), (0.68+-0.03). We have found the progressive decreasing NAA/Cr in the PPCG and increasing of Cho/Cr for the patient of NPDG, CIPDG, DPDG, associated with CI. The analysis of the DMN revealed a gradual reduction in functional connectivity for the patients of DPDG in the cuneus, precuneus and PPCG, which correlate with severity of CI. Our findings suggest that RSNs involving areas of the cerebellum and frontal lobe, that could be interpreted as a potential compensatory mechanism to functional disorders caused by the CI. In NPDG connections between APCG and PPCG, and inferior parietal gyrus bilaterally were found. In NPDG activation of APCG decreased, but connectivity patterns persisted.
Conclusion: fMRI in RS, and MRS data gives as markers of neuronal dysfunction in patients with PD and different level of CI.

B-0859 11:51

Eloquent brain areas localisation by functional MRI in tumour resection surgery

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Purpose: To correlate the Neuronavigated Functional Magnetic Resonance Imaging (fRMI) obtained with motor and language tasks with cortical stimulation during tumour resection surgery.
Methods and Materials: 48 patients with tumours in or around motor and language areas were studied preoperatively with Functional 1.5 T Magnetic Resonance Images (hand motor and language BOLD images). The images were processed and integrated into a Brain Lab Vector Vision2 Neuronavigation System and compared during surgery with cortical and subcortical stimulation. Motor and language tasks were the same at MR setting and at the operating room. The differences were calculated and sensitivity and specificity determined.
Results: A very good correlation was found in the hand motor area assessed by fMRI when motor task was made actively by patient (sensitivity and specificity of 96.8%). Language BOLD images has a low sensitivity and specificity (37 and 66% respectively) and is not a reliable method to locate and preserve language function during surgery. Patients who cannot execute motor task actively were assisted and an activation area 9-13 mm caudal to motor area confirmed by CS were found in all of them.
Conclusion: Although Cortical and Subcortical stimulation are the gold standard in function location and preservation, progresses have been made in development and performance in Image guided neurosurgery. A multimodal imaging approach and its correlation with cortical and subcortical stimulation is encouraged in order to progress in understanding in mechanisms of activation and connectivity of eloquent brain areas.

10:30 - 12:00 **Room L/M**

Physics in Radiology

SS 1713

Novel MRI techniques

Moderators:
T.G. Maris; Iraklion/GR
W.J.M. van der Putten; Galway/IE

B-0860 10:30

Optimisation of k-space sampling and view-sharing parameters in time-resolved MR angiography

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Purpose: To optimise k-space sampling parameters in contrast-enhanced time-resolved MR angiography with interleaved stochastic trajectories (TWIST-MRA) for vessels with varying calibres.
Methods and Materials: With TWIST-MRA, the centre of k-space (surface area fraction fA) is acquired for every dynamic phase. An evenly distributed fraction fB of the periphery is updated, supplementing the remainder with previously or subsequently acquired data (forward and backward sharing, respectively). TWIST acquisition was simulated in a 2D cross-sectional vessel model (diameter=[3.5,10 pixels]). Dynamic signal profiles were constructed from aortic enhancement curves measured with MRA. For scan time reduction factors (RF=fA+fB*(1-fA)) of 20% and 35% of full k-space acquisition time, the optimal combination of fA and fB in terms of maximal signal enhancement (SEmax) and vessel blurring (VB, defined as average difference between original and simulated image) was determined.
Results: Backward sharing produced higher SEmax and lower VB than forward sharing. For RF=20%, SEmax was optimal for fA/fB=20/0%, resulting in 84%, 93% and 96% of maximum input enhancement for diameter=3.5 and 10 pixels, respectively. For RF=35%, relative SEmax was 90%, 91%, and 95% for diameter=3.5 and 10 pixels, respectively. VB was slightly higher for RF=20% compared to RF=35%.
Conclusion: Optimal parameter selection depends on the area of interest. For maximum enhancement of small vessels (diameter=3 pixels), backward view sharing should be used and fA should be chosen as large as possible given a certain RF. Reducing dynamic scan time by decreasing RF from 35% to 20% only slightly decreased enhancement of small vessels, while low VB was maintained.

B-0861 10:39

MRI-drawn pulsatile flow, can we accept it? In-vitro validation using aortic flow model

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Purpose: MR phase-contrast imaging demonstrates pulsatile blood flow velocity. The pulsatile flow pattern may show blood flow abnormality. The MR-based pulsatile flow pattern was validated in vitro.
Methods and Materials: An electromechanical pulsatile flow model was self-established to simulate aortic blood flow. The model consisted of cylinder pump, check valves, electromagnetic flowmeter, 19-mm silicone tube, 3 manometers, computerised controller, and ECG generator. As input variables, heart rate (40-90 bpm) and systolic time interval ratio (30-60%) were controlled. Stroke volume was fixed to 90 ml. The velocity data simultaneously acquired by embedded electromagnetic flowmeter was used as the reference standard. Under strictly controlled condition, MR phase-contrast imaging (3 T,

40 phases, 100Cm/sec Venc) and particle-induced velocimetry (PIV, 15 Hz repetition rate, 2Kx2K camera, Rhodamine-B fluorescent seeding particles) were performed. By two-time data acquisition at each setting, 36 data sets were acquired and compared.
Results: At whole 18 flow settings, the embedded flowmeter measured maximal, minimal, and mean velocities as 84.02, 2.30, and 37.02 Cm/sec, respectively. Whereas, MRI and PIV showed 76.15, 2.77, 35.83 Cm/sec and 48.02, 1.66, 21.73 Cm/sec, respectively. Maximal, minimal, and mean velocities and time to half flow volume showed significant difference among 3 modalities ($p < 0.001$). However, the correlation with reference standard was significant by MRI and PIV ($p < 0.005$). MRI showed significantly higher correlation coefficient than PIV for maximal and mean velocities, and time to half flow volume, except minimal velocity ($p < 0.001$).
Conclusion: Although MR-drawn pulsatile flow pattern showed blunted, expanded, and delayed pulsatility, the correlation with standard reference was acceptable.

B-0862 10:48

Automated selection of optimum acceleration parameters for highly accelerated 3D contrast-enhanced MR angiography
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Purpose: To present the methodology and in vivo results which demonstrate how optimum k-space sampling parameters can be selected for highly accelerated (R≥8) 3D contrast-enhanced MRA.
Methods and Materials: When acceleration is performed along the two phase encode directions (Y, Z) of 3DFT acquisition, there is considerable flexibility in selecting the individual accelerations R_Y and R_Z so that their product $R_Y \times R_Z$ equals the target acceleration R. We show that the performance of a trial (R_Y, R_Z) pair can be predicted by determining a metric which can be calculated from the 3D coil sensitivity images. These images are themselves generally acquired prior to the contrast-enhanced run of a CE-MRA exam. High-speed computation enables the multitude (several hundred) of trial R-pairs to be evaluated within seconds, allowing the optimum to be used in the actual contrast-enhanced run. The method is tested in CE-MRA exams of the abdomen, calves, and feet.
Results: For a given acceleration factor, e.g. R=8, the optimum R-pair depends strongly on the anatomic region under study, the interplay of the coil array with the body habitus of the individual patient, and the amount of air in the FOV. It is shown that acceleration optimisation can provide marked improvement in image quality compared to reference accelerations. Time-resolved contrast-enhanced angiograms of the feet can be routinely generated with sub-millimetre isotropic resolution and 6.5 sec frame times.
Conclusion: Automated selection of optimum parameters for 2D acceleration in CE-MRA can be done on a patient-specific basis and permits high image quality.

B-0863 10:57

Performance of fat-suppression in large field-of-view 3D T1w gradient echo imaging of the body using a 3 T system with improved magnetic field homogeneity
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Purpose: To compare the technical performance of spectral pre-saturation (FatSat) and two-point Dixon fat-water separation (Dixon) for T1-weighted 3D large FOV volume interpolated breath-hold examinations (VIBE) at 3 T.
Methods and Materials: Ten healthy volunteers (7m, 3f, mean age 41 y, range 26-71 y) were prospectively examined using a novel 3 T whole-body MRI scanner (MAGNETOM Prisma, Siemens Healthcare) with excellent magnetic field homogeneity (1.1 ppm at 50 cm diameter spherical volume). 3D VIBE with FatSat and Dixon was applied with identical spatial parameters (coronal FOV 450x363x192 mm^3, resolution (1.6 $mm)^3$). TR and TE were minimised for each sequence (FatSat: TR=2.9 ms, TE=1.1 ms; Dixon: TR=4.1 ms, TE=1.3/2.6 ms). Flip-angle was 10°. Acquisition time was 20s for both methods with parallel imaging acceleration factors 3 using GRAPPA (with FatSat) and 6 in two directions using CAIPIRINHA (with Dixon). Two radiologists rated image quality on a 4-point scale (excellent-good-fair-poor) and analysed the images for fat-suppression artefacts. Fat-suppression was assessed quantitatively by contrast measurements of solid tissue (liver, psoas muscle) compared to adjacent fatty tissue.
Results: Fat-suppression artifacts were significantly less with Dixon than with FatSat (0.5±1.1 vs 6.1±2.1/dataset; $P < 0.001$). Dixon provided significantly higher contrast than FatSat for liver (0.85±0.03 vs 0.78±0.06; P=0.003) and muscle (0.85±0.04 vs 0.77±0.08; P=0.02). Dixon was more often affected by noise from parallel imaging than FatSat (6 vs 1 dataset). Overall image quality of Dixon was rated (4 excellent, 4 good, 2 fair) vs. FatSat (8 good, 2 fair; P=0.2).
Conclusion: Dixon provides significantly better quality of fat-suppression than FatSat for large FOV body imaging at 3 T.

Author Disclosures:
M.D. Nickel: Employee; Siemens Healthcare. **W. Horger:** Employee; Siemens Healthcare. **B. Kiefer:** Employee; Siemens Healthcare.

B-0864 11:06

MR thermometry feasibility during LITT in ex vivo porcine pancreas
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Purpose: Laser-induced thermotherapy (LITT) is a minimally invasive treatment technique modality to treat neoplastic tissue. LITT effects are influenced by parenchymal heat distribution and temperature monitoring is critical for the procedural outcome. We evaluated effects of LITT on intensity variation during porcine pancreases MR examination, in order to assess the feasibility of MR thermometry during ablation procedure on pancreas.
Methods and Materials: Two ex vivo porcine healthy pancreases undergoing LITT (Nd:YAG laser, Power 2 W, Energy 480J) were monitored by a 1.5-T MR scanner, utilising two fast Inversion-Recovery sequences (IRTF and SRTF). Each pancreas was scanned during the whole treatment (session time 240s) and images were analysed with MATLAB®; signal intensity was recorded in two Regions of Interest (ROIs): ROI-a and ROI-b, positioned at 7 and 20 mm from the tip of laser applicator, respectively.
Results: In ROI-a, temperature increase caused a significant signal intensity decrease in both sequences, while in ROI-b signal showed a negligible variation due to the larger distance from the applicator. Evaluating ROI-a, IRTF presented a higher thermal sensitivity than SRTF (i.e., -0.076s^{-1} for IRTF and -0.067s^{-1} for SRTF) in both pancreases. The result is confirmed by the maximum decrease of the signal intensity during the procedure (-35 for IRTF and -23 for SRTF). Signal decrease with SRTF sequence showed a significant linear correlation with time ($P < 0.01$).
Conclusion: MR thermometry seems to be a valuable non-invasive and time-effective approach to monitor thermal ablation effects on pancreas; in our experience IRTF is more sensitive than SRTF.

B-0865 11:15

Evaluation of abdominal organs by using breath hold and non-breath hold diffusion-weighted imaging
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Purpose: Our aim was to evaluate the apparent diffusion coefficient (ADC) values of normal abdominal parenchymal organs and signal to noise ratio (SNR) measurements in the same patients with breath hold (BH) and non-breath hold (NBH) diffusion weighted imaging (DWI).
Methods and Materials: Thirty-five healthy patients underwent both BH and NBH DWI. Free hand region of interest (ROI) was placed on right hepatic lobe, spleen, cortices of kidneys and pancreas. ADC values were calculated for every organ on both BH and NBH sequences. Image noise was measured in a ROI placed outside the abdomen. SNR was calculated using the formula: SNR = signal intensity $(SI)_{(organ)}$/standard deviation $(SD)_{(noise)}$.
Results: There were no statistically significant differences in ADC values of the parenchymal abdominal organs between BH and NBH DWI sequences ($p > 0.05$). There were statistically significant differences between SNR values of organs on BH and NBH DWIs. SNR of NBH DWI sequences were better than BH sequences ($p < 0.01$). Patients were divided into two groups as group1 patients > 65 years old (n= 9) and group 2 patients ≤ 65 years old (n= 26). Statistically significant differences in SNR measurements of the kidneys between group 1 and 2 were found on both BH and NBH DWI ($p < 0.05$). SNR of kidneys decreases with age.
Conclusion: Non- breath hold (free breathing) DWI technique significantly reduces image noise and increases SNR for abdominal examinations. We recommend NBH technique for the evaluation of abdominal organs by DWI.

B-0866 11:24

Correlation between presurgical DTI-tractography motor tract definition and intraoperative evoked potentials assessment
Y.P. Velasco Díaz[1], J. Sanchez Fernandez[1], J. Quispe Bravo[1], G. Rivera Sierra[1], P. Puyalto[2], C. Aguilera[1], M. Virumbrales Cancio[3], A. Olazabal[2]; [1]*Hospitalet de Llobregat/ES*, [2]*Badalona/ES*, [3]*Sant Cugat del Valles/ES (patricia.velasco@bellvitgehospital.cat)*

Purpose: The objective of the study was to correlate the reliability of MR tractography sequences to define the pyramidal tract and its translation into the gross anatomy (obtained by evoked potentials)in order to conclude that MR tractography assesses, before surgery, accurately the distance between the pyramidal tract and tumour.
Methods and Materials: 43 patients with gliomas near the pyramidal tract were prospectively. Histological analysis confirmed: 13 diffuse anaplastic gliomas, 4 oligoastrocytomas and 26 GBM. In the 43 patients the motor tract was identified by presurgical MRI studies (DTI sequences and tractography)

and MRI studies within 72 hours after surgery. The way of defining the pyramidal tract was through the intersection of the fibbers passing through three zones labelled in the precentral gyrus on the internal capsule and ipsilateral cerebral peduncle. After craniotomy, the central sulcus was visually identified and confirmed by evoked potentials. Direct cortical monopolar high frequency phase (250 Hz) stimulation was performed. For cortical stimulation an 8 contacts electrode was used whereas a current waveform with eight electromyograms was used for evoked potentials continuous monitoring. When resection approaches the pyramidal tract, subcortical stimulators were used and the electromyographic response was observed after subcortical stimulation.
Results: The distance between the resection cavity and the motor tract in tractographic sequences postoperatively were 2.5 to 23.7 mm. The results were correlated with data obtained from cortical evoked potentials monitored during surgery. There was a significant linear correlation of 1.08 by applying a regression test between distance and stimulus intensity (R2 = 0.8202, $P < 0.001$).
Conclusion: Correlation was demonstrated between the electrophysiological and DTI in the analysis of the pyramidal tract by imaging based on the use of direct subcortical stimulation.The DTI should be systematically included in the standard imaging protocol for the study of brain tumours both for etiologic diagnosis to treatment planning.

B-0867 11:33

The principles of diffusion-weighted magnetic resonance imaging (DWI-MR): experimental models and clinical applications
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Purpose: To clarify the origin of the findings obtained with Diffusion-Weighted Magnetic Resonance Imaging (DWI) in its clinical (current and future) applications.
Methods and Materials: DWI measures the speed of the random movement ("diffusion") of extra-cellular water molecules, which varies among different tissues according to several parameters such as the viscosity of the milieu, the concentration of inorganic solutes and of macromolecules, the membrane permeability, the number of cells and the temperature. In the diagnostic workout of several diseases DWI is currently included (early recognition of brain ischemia, differentiation between benign and malignant neoplasms, monitoring of cancer outcome after therapy), while in some fields its possible role is under investigation (characterisation of diffuse liver disease, evaluation of pancreatic and intestinal inflammation, assessment of foetal organ development, identification of physiologic changes of the endometrium during the menstrual cycle).
Results: The speed of diffusion decreases with increasing viscosity, increasing concentration of inorganic solutes, increasing concentration of macromolecules; it increases with cell membrane rupture and with the growing number of cells, and directly parallels the changes in the temperature. These relationships are confirmed by the measurement of diffusion in a series of experimental models (raw versus boiled eggs and potatoes; distilled water versus 5% sodium chloride water solution and emulsion of butter in water; ripen versus rotten peaches; 25 °C versus 50 °C 5% sodium chloride water solution and air-temperature versus frozen beefsteak).
Conclusion: Non-human experimental models help our comprehension of the factors influencing the speed of water diffusion in human healthy and diseased tissues.

B-0868 11:42

Side effects in ultra-high-field-MRI at 7 Tesla in comparison to a "Mock-up"-scanner
B. Friebe[1], A. Wollrab[1], M. Thormann[1], M. Grüschow[2], K. Fischbach[1], J. Ricke[1], S. Kropf[1], F. Fischbach[1], O. Speck[1]; [1]*Magdeburg/DE*, [2]*Zurich/CH*
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Purpose: To determine the subjective experience of subjects undergoing 7-Tesla-MRI compared to a "Mock-up"-Scanner with no magnetic field.
Methods and Materials: 44 healthy subjects were exposed both to the B0-Field of a 7-Tesla-whole-body MRI and a realistic "mock-up" scanner with no magnetic field. Subjects were blinded to the actual field strength and no scanning was performed, i.e. no RF or gradient exposure. After exposure to the B0-Field, subjects rated their experience regarding potential sensations of discomfort, such as phosphenes, nausea, dizziness or vertigo.
Results: The most frequently observed side effect was vertigo while entering the gantry, which was reported by 36.3 % (n= 16). Other frequent side effects were the appearance of phosphenes (18.2%), unsteady gait after exposure (13.6%), thermal heat sensation (13.6%) and dizziness (11.4%). Nausea occurred in no case. All side effects were reported significantly more often after 7-Tesla exposure. However, regarding these five main side effects 19 subjects (43.2 %) neither reported them in the 7-Tesla-Scanner nor in the mock-up scanner.
Conclusion: Light vertigo while entering the gantry is the main side effect of Ultrahigh-Field MRI consistent with previous reports. Other light subjective sensations as the appearance of phosphenes, unsteady gait after exposure, thermal heat sensation or dizziness can occur in a small percentage, of which in part might not be correlated to the magnetic field exposure but to the subject consent procedure, sensitizing them to possible effects. The appearance of nausea in this study was well below that previously reported in the literature.

B-0869 11:51

MR safety: the potential of ferromagnetic detection systems and the challenge of a ferrous-free policy
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Purpose: To evaluate advantages and limitations of ferromagnetic detection systems in a ferrous-free MR environment.
Methods and Materials: The commercial ferromagnetic detection systems (Ferroguard®, Metrasens) consisted of a wall-mounted, high sensitivity patient screener (optical alarm) and a lower sensitivity doorway detector (optical and acoustic alarm), mounted in front of the magnet room entry (in-swinging door, 1.5 T). For the latter, the detected signal (magnetic flux density variations) was processed to activate the audible alarm only if appropriate. Besides a foldable wheelchair and a patient bed (fixed height) were supplied, both MR conditional 3 T and not triggering any detector alarm. Additionally, site staff wore ferrous free clothing. Patient screening was carried out on all walking patients after changing clothes and the outcome registered.
Results: The "patient screener" was well accepted by staff and patients. 3 patients out of 399 were refused the scheduled exam because of ferromagnetic items brought out by it. The door entry detector required repeated fine tuning to adjust to site conditions and staff behaviour. In order to avoid false alarms, staff needs to comply with minimal "behaviour rules".
Conclusion: Patient screener and doorway detectors are complementary. The patient screener demonstrated simple in use, reliable in detecting hidden ferrous items and helpful in avoiding potentially critical patient scanning. Positioning the doorway detector a few meters ahead of the exam room entry facilitates calibration and correct staff behaviour. To gain the most, the MR site should embrace a "ferrous free" policy.
Author Disclosures:
N. Oberhofer: Equipment Support Recipient; Merano Hospital. **N. Surname:** Equipment Support Recipient; Merano Hospital.

10:30 - 12:00 **Room N/O**

Emergency Radiology

SS 1717

New strategies in imaging

Moderators:
J.M. Artigas; Zaragoza/ES
C. Colantoni; Milan/IT

B-0870 10:30

Does inclusion of imaging in the work up of patients with clinically suspected appendicitis reduce the rate of unnecessary surgical procedures?
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Purpose: Since February 2010 new Dutch guidelines have been implemented recommending the use of US or CT to confirm or refute clinically suspected appendicitis before (laparoscopic) surgery. For equivocal cases with US additional imaging (CT/MRI) is recommended. This study aimed to see whether these new guidelines lowered the percentage appendix sana.
Methods and Materials: This retrospective study included all consecutive patients operated for clinically suspected appendicitis at our hospital from 2008-2009 (before guidelines) and 2011-2012 (after guidelines). The use of imaging (none versus US, CT and/or MRI) and its findings were recorded. Surgical and histopathological findings -where available- were notified. The primary study endpoint was the number of appendix sana before and after the guideline implementation.
Results: 1556 patients were included, of which 756 were collected before the implementation of the guidelines and 800 after. During the pre-implementation period, 36.3% of the patients received imaging focussed on the appendix. Post-implementation, 97.4% of the patients received imaging before surgery. The average percentage of an 'appendix sana' before the guidelines was 23.2%. After implementation, this average percentage dropped significantly to 6.2% ($p < 0.001$).
Conclusion: Use of preoperative imaging in all patients with suspected clinically appendicitis result in a significant reduction in the percentage of

'appendix sana'. This suggests that the implementation of imaging in the work up of these patients could be an effective strategy to reduce the number of unnecessary surgeries.

B-0871 10:39

Diagnostic imaging pathways and clinical outcomes of acute appendicitis: a multi-institutional cross-sectional study

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Purpose: To investigate imaging utilisation patterns and the negative appendectomy rate (NAR) in metropolitan Seoul.
Methods and Materials: A cross-sectional study involving 2321 adolescents and adults undergoing appendectomy in 2011 at eleven hospitals.
Results: Ten sites acquired multi-phase computed tomography (CT). The typical effective radiation dose exceeded 10 mSv at 10 sites and 20 mSv at 2 sites. Overall imaging utilisation rate was 99.7% (95% confidence interval, 99.4%-99.9%). CT and ultrasonography utilisation rates as an initial imaging modality were 93.1% (92.0%-94.1%), and 6.5% (5.6%-7.6%), respectively. Relatively higher ultrasonography utilisation was associated with younger age, female, and presentation during working hours. The overall NAR was 4.1% (3.3%-4.9%). The NAR in patients undergoing CT only, complementary ultrasonography following CT, ultrasonography only, and complementary CT following ultrasonography were 3.3% (2.6%-4.1%), 27% (14%-44%), 9% (4%-16%), and 8% (2%-20%), respectively. The use of ultrasonography instead of CT as the initial imaging modality was significantly associated with the higher NAR (adjusted odds ratio [AOR], 2.28 [1.22-4.27]; risk difference, 4.4 [0-8.8] percentage points), however, the population attributable risk was 0.3 [0-0.6] percentage points. The choice between CT and ultrasonography did not significantly affect appendiceal perforation (AOR, 1.11 [0.74-1.66]).
Conclusion: We observed a very high CT utilisation rate and a low NAR in metropolitan Seoul, similar to those recently reported from the United States. The use of CT instead of ultrasonography as the initial imaging modality significantly decreased NAR. However, only marginal further reduction of the NAR would be achieved by additional utilisation of CT in the population.

B-0872 10:48

Signs of acute appendicitis on CT in comparison with both histopathological findings and C-reactive protein

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Purpose: To assess signs of acute appendicitis (AA) on multidetector computed tomography (MDCT) and to compare findings with both histopathological evaluation and C-reactive protein (CRP) levels.
Methods and Materials: Preoperative MDCT images of 76 patients with histopathologically confirmed AA were retrospectively interpreted by two radiologists in consensus. Criteria for AA were appendiceal wall thickness > 2 mm with ring-like contrast enhancement, increased cross-sectional diameter > 6 mm, and periappendiceal fat attenuation. Abscess formation was considered as a specific sign of appendiceal perforation. Patients were categorised into one of three groups (GR) based on histopathological classification: ulcero-phlegmonous (GR1), gangrenous (GR2), and perforation with abscess formation (GR3). CRP levels were correlated using receiver operating characteristic (ROC) curve analysis.
Results: 49 patients were assigned to GR1, 5 to GR2, and 22 to GR3. AA was diagnosed on MDCT in 42/49 cases (85.7%) in GR1, and 2/5 cases (40%) in GR2. In the remaining patients MDCT was unremarkable, respectively. Abscess formation with a diameter > 3 mm was diagnosed in 19/22 cases (86.4%) in GR3. CRP levels were in normal range in 4/49 patients (8.2%) in GR1, mildly elevated in all patients in GR2, and never < 59 mg/l in GR3. Mean CRP levels significantly correlated with histopathological severity of inflammation ($p < 0.03$), showing an optimal cut-off point for perforation > 72 mg/l.
Conclusion: MDCT is a powerful diagnostic tool to depict signs of AA and is required immediately in patients with CRP levels > 72 mg/l to avoid complications. CRP levels and signs of AA on MDCT taken together may influence treatment strategy.

B-0873 10:57

Acoustic radiation force impulse elastography in diagnosis and staging the severity of acute appendicitis

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Purpose: The aim of this study is to investigate the qualitative and quantitative role of acoustic radiation force impulse (ARFI) elastography in the diagnosis of acute appendicitis and also to compare it with histopathologic results along with Alvarado score.
Methods and Materials: Forty-eight follow-up patients with no apparent complaint and 53 patients with right lower quadrant pain were evaluated using ARFI elastography and ultrasonography (US). Following the recording process for Alvarado scores, the severity of appendicular inflammation was assessed in the 48 patients who were diagnosed with acute appendicitis on ARFI elastography and later underwent surgery. Once the findings on imaging were confirmed, the results were compared and also the sensitivity and specificity for Alvarado scores, ARFI elastography and US were then calculated.
Results: Alvarado score had a sensitivity of 79.59% and specificity of 93.51%, ARFI elastography had sensitivity and specificity of 100% and 96.7% each, whereas sonography had sensitivity of 91.03% and specificity of 96.70%. According to the inflammation severity rates, 14 patients had mild, 12 had moderate, and 22 had severe appendicitis.
Conclusion: The combined use of US and ARFI elastography raises both qualitative and quantitative sensitivities in the diagnosis of acute appendicitis and can also be used in severe and pervasive inflammation.

B-0874 11:06

Usefulness of contrast-enhanced ultrasound in the diagnosis of acute gangrenous cholecystitis: a comparative study with surgical and pathological findings

I. Carbonell, R.R. Revert, M. Martínez, Y. Fernández, J. Vizuete, T. Ripolles; *Valencia/ES (medisa740@gmail.com)*

Purpose: Determine usefulness of contrast-enhanced ultrasound (CEUS) for the diagnostic of acute gangrenous cholecystitis (AGC), compared with pathologic specimens as gold standard.
Methods and Materials: From December 2011 to March 2013, patients with clinical and sonographic diagnosis of acute cholecystitis underwent a CEUS examination. CEUS diagnosis of AGC was made when discontinuity of gallbladder wall enhancement was seen after contrast injection. Sonographic findings prospectively evaluated were: wall thickness, biliary sludge, lithiasis, Murphy sign, wall striations, intraluminal membranes, wall interruption, pericholecystic fluid, or hyperemia. We included only patients who underwent cholecystectomies 24 hours after CEUS. Sonographic was compared with pathologic analysis of the gallbladder specimen. Sensitivity, specificity, positive and negative predictive values, and CEUS accuracy were calculated. Retrospectively, two experienced radiologists reviewed sequences to calculate interobserver agreement, using kappa statistics.
Results: 64 patients were included (32 women, mean age of 71 years). Final pathological diagnoses were 6 chronic cholecystitis, 10 acute cholecystitis and 48 AGC. Absence of gallbladder wall enhancement on preoperative CEUS image was accurately associated with pathologically confirmed AGC (sensitivity, specificity and accuracy of 79.2%, 81.3% and 79.7%). Interobserver agreement was good (k value: 0.719). Radiologic criteria with highest sensitivity and specificity to gangrenous form were defects of enhancement, wall striations and biliary sludge. Intraluminal membranes had high specificity (92.8%) but low sensitivity (22.9%).
Conclusion: Local or widespread absence of gallbladder wall enhancement on CEUS is associated with the presence of AGC.

B-0875 11:15

Diagnostic accuracy of full-body linear X-ray scanning in trauma patients in comparison to CT

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Purpose: To evaluate the diagnostic accuracy of full-body linear X-ray scanning (LS) in polytrauma patients in comparison to computed tomography.
Methods and Materials: Following institutional review board approval, 106 polytrauma patients (female, 33; male 73; mean age, 46.7 years; age range, 16 - 93) were retrospectively included in this study. All patients underwent linear slot X-ray scanning (LS; Lodox Statscan, South Africa) of the whole-body including extremities (scan time,13s/1.80m; entrance dose, 0.12 mGy), and 128-multi-slice computed tomography (MSCT; Definition Edge, Siemens, Forchheim, Germany) covering neck, thorax, abdomen, and pelvis during 2012. Diagnostic accuracy of LS for the detection of fractures of the truncal skeleton and pneumothoraces was evaluated in comparison to MSCT by two observers in consensus. Extremity fractures detected by LS were documented.
Results: Overall sensitivity of LS was 50.0%, specificity 93.3%, positive predictive value 91.2%, and negative predictive value 57.5% in comparison to CT. Sensitivity for vertebral fractures was 16.7%, and specificity 100%. Sensitivity was 50.0% and specificity 98.2% for all other fractures. Pneumothoraces were detected in 13 patients by CT, but not by LS. 30 fractures of the extremities were detected by LS, but not covered by MSCT.
Conclusion: Diagnostic accuracy of LS is limited in the evaluation of acute trauma of the truncal skeleton. LS allows for fast and ultra-low dose whole-body X-ray imaging, and may be valuable for detecting extremity fractures in trauma patients additional to CT imaging.

B-0876 11:24

Bowel and mesenteric injuries in blunt abdominal trauma: the role of multidetector-CT for addressing a surgical approach

M. Tonerini; *Pisa/IT (m.tonerini@tiscali.it)*

Purpose: To describe the MDCT findings of blunt bowel and mesenteric injuries (BBMI) and to determine which types of lesions warrant a surgical approach.
Methods and Materials: Retrospective study of 30 patients (18 male; 12 female; mean age 35 y.o). who sustained a major trauma and who were evaluated with a 64- MDCT in a I level Emergency Department. The MDCT findings were evaluated by an experienced staff dedicated for Emergency Radiology (24 h) and they were then confirmed by laparotomy/laparoscopy or by MDCT follow-up.
Results: 70% patients had surgically important BBMI and 30% of patients had surgically unimportant BBMI. Bowel wall defect, bowel wall ischemia, extraluminal air, mesenteric vessel beading or extravasation and abrupt termination of mesenteric vessels showed the best positive likelihood for surgically important BBMI. Mesenteric infiltration, intraperitoneal fluid, bowel wall thickening or bowel wall abnormal enhancement were not specific findings of BBMI and they did not warrant an emergent surgical approach. The absence of peritoneal fluid showed the best negative predictive value.
Conclusion: MDCT accurately revealed surgically important BBMI. When nonspecific features of BBMI are the only CT findings, the need for surgical intervention is highly dependent on clinical judgment. Reevaluation with MDCT within 6-8 hours may help to elucidate the significance of such findings.

B-0877 11:33

Follow-up and characterisation of indeterminate spleen lesions in primary CT after blunt abdominal trauma: potential of MR imaging

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Purpose: To determine the value of MR imaging for follow-up and characterisation of indeterminate spleen lesions in primary CT of patients with blunt abdominal trauma.
Methods and Materials: Twenty-five patients (8 female, mean age 51.6±22.4 years) with an indeterminate spleen lesion diagnosed at CT after blunt abdominal trauma underwent MR imaging with T2- and T1-weighted images pre- and post-contrast material administration. MR images were reviewed by two radiologists. Age, gender, injury mechanism, injury severity score (ISS), management of patients, time interval between CT and MR imaging, and length of hospital stay were included into the analysis. Patient history, clinical history, imaging and two-month clinical outcome including review of medical records and telephone interviews served as reference standard.
Results: From the 25 indeterminate spleen lesions in CT, 11 (44%) were traumatic and 14 (56%) non-traumatic. The ISS (P <.001) and length of hospital-stay (P=.03) were significantly higher in patients with traumatic spleen lesions as compared to those without. All other parameters were similar among groups (all,P>.05). The MR imaging features ill-defined lesion borders, variable signal on T1-and T2-weighted images, focal contrast enhancement indicating traumatic pseudoaneurysm, perilesional contrast enhancement and edema were indicative for traumatic spleen lesions. As compared to CT (2/25), MR images (5/25) better depicted thin subcapsular hematomas as indicator of traumatic spleen injury.
Conclusion: MR imaging shows value for follow-up and characterisation of indeterminate spleen lesions in primary CT after blunt abdominal trauma and is helpful for discriminating traumatic from non-traumatic spleen lesions.

B-0878 11:42

X-ray findings and morphologic changes in lungs after thermal injury

E.A. Beresneva, S.V. Smirnov, S.V. Sheviakova, T.G. Spiridonova, M.V. Barinova; *Moscow/RU (erasklif@mail.ru)*

Purpose: To characterise changes in lungs after thermal injury.
Methods and Materials: We have studied chest X-ray findings and lung morphology changes following thermal injury in 240 patients distributed in 3 groups: isolated inhalation injury (Group 1), skin burn only (Group 2), the combination of inhalation injury with a skin burn (Group 3).
Results: Following inhalation injury, lung edema and pneumonia were most commonly revealed by X-ray at early stage (day 1-2, and day 3-4, respectively). We identified a radiographic sign indicating a terminal bronchiole obstruction, and appearing in X-ray as peripherally located (in the lung) small clear bubbles closely arranged in a "mulberry" pattern. Terminal bronchiole obstruction was confirmed morphologically. In 45.1% of Group 2 patients no abnormalities in lungs were seen. Pneumonia was the most common complication occurring at week 2-3. In combination of inhalation injury and skin burn, chest X-ray showed no abnormal signs in lungs in 35% of patients in initial 5-6 days. Only some patients showed the radiologic sign of "mulberries" or signs of venous congestion. Advanced pulmonary edema and pneumonia were reveled later: at day 7 or 8. Morphology demonstrated increased blood volume in all vessels, sludge, and blood clots.
Conclusion: We found radiologic and morphologic differences between the three groups. The radiologic sign of "mulberries" is consistent with the terminal bronchiole damage and lumen obstruction. Absence of abnormal X-ray signs in lungs of patients with combination of inhalation injury and skin burn in initial several days suggests the presence of severe microcirculation impairments.

B-0879 11:51

The lung CT patterns in fat embolism syndrome

M. Piolanti, M. Fiscaletti, C. Coniglio, G. Dalpiaz, M. Miceli, S. Violini, L. Barozzi; *Bologna/IT (marpiolanti72@gmail.com)*

Purpose: The aim of this study is to define the lung CT pattern of the pulmonary involvement in fat embolism syndrome (FES).
Methods and Materials: In this study, 3 radiologists retrospectively reviewed 18 CT studies of patients with clinical diagnosis of pulmonary fat embolism syndrome. The protocol was approved by the Ethics Committee of the AUSL of Bologna, Italy. Imaging evaluation was particularly focused on the lobular abnormalities, and the terminology used followed the Fleischner Society glossary of 2008. Presence and extension of all CT signs of interstitial and alveolar involvement were carefully assessed by consensus by the observers. Statistical analysis was performed to analyse distribution of the findings and correlate them with the clinical parameters.
Results: All patients in our series showed presence of nodules and micro-nodules with random distribution. Consolidations and ground-glass opacities were present in all patients as well. Consolidations had predominantly a dependent distribution, while ground glass opacities had always a random distribution. Ground glass opacities and nodules resulted to be prevalent in the upper lobes while consolidation prevailed in the lower lobes.
Conclusion: In conclusion, from the CT findings of our series FES seems to have a peculiar CT pattern; although it is not a specific CT pattern in itself, in the proper clinical context CT findings might well suggest, or confirm, the diagnosis of pulmonary FES.

10:30 - 12:00 **Conf. Room M3**

Interventional Radiology

SS 1709

Percutaneous ablation

Moderators:
C.W. Kim; Busan/KR
G. Widmann; Innsbruck/AT

B-0880 10:30

Systemic hyperthermia after local tumour ablation: comparison of monopolar and multipolar radiofrequency ablation

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Purpose: To assess changes in body temperature during mono- and multipolar radiofrequency (RF) ablation.
Methods and Materials: 112 consecutive patients (62 male; 63.8±12 years) undergoing RF ablation for primary or secondary hepatic malignancies were included in this retrospective analysis. All monopolar ablation procedures (n=164) were performed with the RF3000 system (Boston Scientific, Natick, MA) with LeVeen probes (2-4 cm), while multipolar ablation procedures (n=69) were performed using the Celon Power generator (Celon, Teltow, G) with 1 to 6 RF-probes. Body temperature was continuously monitored throughout all procedures via an oral temperature probe (Datex-Ohmeda, GE-Healthcare, Chalfont St. Giles, UK). Data were statistically analysed using Wilcoxon test and uni- and multivariate analysis of variance.
Results: Both ablation techniques resulted in a significant increase in body temperature ($p < 0.0001$) with an average increase of body temperature of 1.4±1.6 (0-5.9)°C in monopolar and 0.7±0.7 (-0.1-2.2)°C in multipolar ablation. The increase in body temperature was significantly lower with multipolar ablation ($p < 0.0001$), when compared with monopolar ablation. Multivariate analysis proved probe size ($p < 0.0001$), ablation duration ($p=0.0002$) and summarised tumour diameter ($p=0.049$) to have a significant influence on changes in body temperature. Proximity to large vessels did not show significant effects on body temperature ($p> 0.05$).
Conclusion: The use of multipolar ablation is an effective option to minimise systematic body heating in RF-ablation of liver tumours. In high-risk patients, this offers a strategy to avoid negative side effects of systemic body hyperthermia, as it may occur in monopolar RF-ablation of large lesions.

B-0881 10:39

Efficay and cost-analysis of radiofrequency ablation compared to surgery for the treatment of benign thyroid nodules

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Purpose: The aim of this study was to evaluate radiofrequency thermal ablation (RFA) efficacy, tolerability and costs, and comparing it to emithyroidectomy, including short stay thyroid surgery, for the treatment of benign thyroid nodules.
Methods and Materials: 29 patients underwent RFA of benign thyroid nodules and were compared with 72 patients surgically treated, either in a standard inpatient or in a short stay surgical regimen. Efficacy, complications, cosmetic score and costs were evaluated.
Results: RFA reduced nodular volume by 68% after 6 months and it was effective in treating all nodule-related clinical problems, including hyperthyroidism, neck symptoms and cosmetic score. RFA and surgery, regardless of the length of the hospital stay, were both safe, although RFA had less complications. RFA, however, did not allow for any pathological analysis of the nodules, which, in 5 patients who underwent surgery (7%), revealed that the nodules harboured malignant cells. RFA costs 1629 €, surgery costs 4668 € and short stay surgery costs 4218 € per patient.
Conclusion: These data suggest that RFA cost-effectiveness is likely to transform our approach to benign thyroid nodules.

B-0882 10:48

CT-guided RF ablation improves survival in patients with liver metastases from breast cancer

A.H. Mahnken[1], K. Kühl[1], P. Bruners[2]; [1]*Marburg/DE*, [2]*Aachen/DE (mahnken@med.uni-marburg.de)*

Purpose: To evaluate the results of radiofrequency (RF) ablation in the treatment of liver metastases from breast cancer.
Methods and Materials: 29 female patients (age 49±12 years) with 76 liver metastases from breast cancer were included in this retrospective analysis. All patients had previously received chemotherapy. Mean lesion size was 2.4±1.3 cm. Extrahepatic metastases were present in 18/29 patients with bone (15/29) and lung (9/29) metastases being the most common locations of extrahepatic disease. CT-guided RF-ablation of liver metastases was performed using 2-4 cm LeVeen probes. Follow-up included contrast enhanced CT every 3-6 months. Mean follow-up period was 18 (1-75) months. Overall survival and factors affecting outcome were analysed using Kaplan-Meier statistics and univariate analysis of variance.
Results: A total of 47 treatment sessions were successfully completed without major complications. Minor complications were observed in 4/29 patients, with one patient requiring embolisation for bleeding. Complete necrosis was achieved in all lesions. Local recurrence rate was 6.5%. Median survival from ablation was 27 months. Corresponding 1- and 3-year overall survival rates were 81% and 33%, respectively. Univariate anaylsis did not show a significant effect of extrahepatic disease, number of metastases or diameters of lesions on survival. There was a trend towards a better survival if RF-ablation was performed within 3 months after the diagnosis of liver metastases (p=0.0669).
Conclusion: Percutaneous RF-ablation has a role in the management of metastatic breast cancer. Extrahepatic disease should not preclude treatment if the liver is the dominant site of metastatic disease.

B-0883 10:57

Patient outcome after pulmonary radiofrequency ablation: a prospective analysis of results from a single centre

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Purpose: To assess the safety of pulmonary RFA and analyse factors affecting overall survival and disease free survival in patients with pulmonary malignancy treated with ablation.
Methods and Materials: 90 tumours in 45 patients treated between April 2009 and August 2013 during 83 separate procedures were analysed using a prospective database. For each patient we recorded the histologically confirmed nature of the primary tumour, site and number of metastases and if the patient received prior chemotherapy or other treatments. On a lesion-by-lesion basis we recorded the lesions' site and size, ablation details, lesional progression free survival, complications and overall survival. Factors were compared using log rank testing and Kaplan-Meier survival analysis performed.
Results: Median overall survival was 105 weeks from initial RFA, with 1, 2 and 3-year survival of 95.5%, 89.9% and 77.7% respectively. 15 lesions (17%) developed recurrence; with mean time to recurrence 32 weeks. 40% of those with recurrence occurred when the lesion abutted a major vessel. Repeat RFA in 8 of these 15 lesions demonstrated no further recurrence in 7. The rate of significant complications (those requiring treatment) was 12%. Patients with ≥ 3 lesions ablated had a mean survival of 150 weeks, compared to 195 weeks in those with a total number of lesions ≤ 2. This came close to statistical significance (p=0.091).
Conclusion: Three-year survival of 77.7% compares favourably with surgery. Patients with ≥ 3 lesions treated are likely to have lower survival than those with ≤ 2 lesions treated.

B-0884 11:06

Diaphragmatic hernias after lung percutaneous radiofrequency ablation: incidence and risk factors

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Purpose: To evaluate diaphragmatic hernias (DH) after PRFA for basal lung nodules and detect risk factors.
Methods and Materials: Between January 2009 and December 2012, presence of DH was retrospectively recorded in all the patients who underwent percutaneous radiofrequency ablation (PRFA) with multitine expandable electrodes for ablation of lower-lobe nodule. All the nodules were classified into three groups according to the location of the tines after deployment relative to the diaphragm. In group 1, the tines were at a distance of more than 1 cm to the diaphragm. In group 2, at least one tine was in contact with the diaphragm without perforation. Finally, in group 3, at least one tine was perforating the diaphragm.
Results: Four cases of DH (3 on the left side, 1 on the right) were recorded in our series of 156 patients (2.3% of our procedures). The delay of onset was 7.8 months. Only the three DH that occurred on the left side were symptomatic (2 intussusceptions and one gastroesophageal reflux) and were surgically repaired. DH occurred in groups 2 (n=1) and 3 (n=3). The electrode was positioned in the centre of the diaphragm in all cases.
Conclusion: The central position of the electrode and the contact of at least one tine with the diaphragm after deployment seem to be a risk factor to develop a DH.

B-0885 11:15

Ablation therapy of hepatocellular carcinoma (HCC): a comparative study between radiofrequency ablation (RFA) and microwave ablation (MWA)

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Purpose: To prospectively evaluate and compare the therapeutic response of radiofrequency ablation (RFA) and microwave ablation (MWA) of hepatocellular carcinoma (HCC).
Methods and Materials: This prospective study was approved by the Institutional review board and written informed consent was obtained from all patients. From September 2008 to December 2011, 53 consecutive patients (42 males/11 females; mean 59 years; range 40-68) underwent CT-guided percutaneous RFA and MWA of 68 HCC-lesions. Inclusion and exclusion criteria were in accordance with the Barcelona Clinic Liver Cancer (BCLC) criteria. Morphologic tumour response (number/location/size) was evaluated by MRI. Follow-up protocol was 24 h post ablation, 3-month intervals post ablation in the first year and 6-month intervals thereafter.
Results: Complete response was documented in 84.4% (27/32) of lesions treated with RFA and in 88.9% (32/36) of lesions with MWA (p=0.6). Complete response was achieved in all lesions ≤2.0 cm in diameter in both groups. There was no significant difference in rates of residual foci of HCC-lesions between RFA and MWA (p=0.15, Log-rank test). Recurrence rates for 3, 6, and 9 months were 6.3%, 3.1%, 3.1% in RFA vs. 0%, 5.6%, 2.8% in MWA. Time-to-progression in patients treated with RFA was 6.6 months vs. MWA 8.3 months. Progression-free-survival was 96.9%, 93.8% and 90.6% (RFA group) at 1, 2, and 3 years and 97.2%, 94.5%, and 91.7% (MWA group), respectively (p=0.98).
Conclusion: In conclusion, RFA and MWA showed no significant difference in the treatment of HCC regarding complete response, rates of residual foci of untreated disease and recurrence rate.

B-0886 11:24

Microwave ablation (MWA) therapy of liver metastases from colorectal carcinoma post-systemic chemotherapy

N.-E.A.N. Mohammed, N.N.N. Naguib, T. Lehnert, T.J. Vogl; *Frankfurt a. Main/DE (nour410@hotmail.com)*

Purpose: To evaluate the safety, efficiency, effectiveness, and overall outcome in patients treated with microwave thermal ablation of colorectal metastases post-systemic chemotherapy.
Methods and Materials: An institutional review board-approval was obtained with informed consent of all patients. Retrospective analysis of prospective intention to treat study was performed from January 2008 to January 2013, and included 92 patients (mean age 56 years SD: 2.6) with 132 liver metastases measuring 0.7-5.0 cm, who were treated with microwave ablation (MWA). Local tumour control, complications, and long-term survival were analysed.

Results: The mean follow-up period was 32.5 months. Complete ablation was achieved in 117 of 132 (88.6%) nodules. Seventeen of the 117 (14.5%) successfully treated nodules developed local recurrence. Univariate analysis showed that tumour size of < 3 cm is a significant risk factor (P = 0.04). Multivariate analysis showed that number of cycles of chemotherapy (FOLFOX) was a significant prognostic factor for overall recurrence (P=0.03), whereas disease-free interval was the significant prognostic factor for distant recurrence (P=0.03). Major complications occurred in 1.1% of patients. No procedure-related mortalities were observed. The 1-, 2-, 3-, and 5-year overall survival rates after the initial ablation were 82, 61.2, 51.2, and 38.3%, respectively. The main cause of death was systemic tumour progression in 65.3% of the patients.
Conclusion: MWA is a safe and effective treatment therapeutic option for patients with liver metastases from colorectal carcinoma post-systemic chemotherapy.

B-0887 11:33

MRI chest parameters used in the assessment of tumour response post-microwave ablation of pulmonary metastases
N.-E.A.N. Mohammed, N.N.N. Naguib, A. Emam, S. Zngos, T. Lehnert, T.J. Vogl; *Frankfurt a. Main/DE (nour410@hotmail.com)*

Purpose: To determine the value of contrast enhanced MRI (CE-MRI) follow-up in the assessment of tumour response of microwave (MW) ablated pulmonary metastases by correlating the results with CE-CT.
Methods and Materials: This prospective study included 130 ablation sessions for pulmonary metastases in 80 patients. CE-MRI chest scanning was performed 1 week before the ablation and at 24 hours, 3, 6, 9 and 12 months post-ablation. Thin-section CT volumetric measurement of the lesions was performed at the same time periods as a second parameter for comparison. The lesion MRI enhancement intensity in each study was estimated, and the ratio to the paraspinal muscle enhancement intensity at the same level was measured (Lesion muscle signal (LMS ratio). The correlations between post-ablation follow-up CT volume of tumours and CE-MRI LMS ratio at the follow-up periods were assessed.
Results: The preablation tumour volumes were in the range of 0.30-6.1 cm (mean: 1.5 cm^3, SD: 1.3). LMS ratio 1 was noted in: preablation due to high contrast enhancement of the tumour,in 24 h post-ablation due to the inflammatory response associated with the thermal ablation and due to tumour residue or progress. Weak correlation was detected between the LMS ratios and CT volumetric changes in 24 h post-ablation. Strong correlation between the LMS ratios was estimated between the follow-up periods of 3 months (Spearman R: 0.62, p=0.0021), 6 months (Spearman R: 0.66,p=0.001), 9months (Spearman R: 0.61, $p < 0.001$) and 12 months (Spearman R:0.7, $p < 0.00001$).
Conclusion: CE-MRI follow-up of the MW ablated lung tumours can be used effectively to assess the tumour response to ablation using LMS ratio as a parameter of assessment.

B-0888 11:42

Mid-term outcome of percutaneous image-guided cryoablation on inoperable extra-abdominal desmoid tumors
M. Havez, F. Cornelis, N. Lippa, S. Al Ammari, M. Kind; *Bordeaux/FR (marion.havez@gmail.com)*

Purpose: To report the effectiveness and mid-term outcome of percutaneous image-guided cryoablation on extra-abdominal desmoid tumors.
Methods and Materials: The institutional review board approved this study and informed consent was waived. Between 2011 and 2012, 13 patients (17 tumors), with a mean age of 39.3 years (15-74), consecutively treated with cryoablation under ultrasound (n=8), computed tomography (n=1) or both (n=8) guidance for extra-abdominal desmoid tumors were retrospectively selected and followed until 2013. The study included 2 patients with Gardner syndrome and 9 recurrences on ablative site after initial surgical treatment. Tumor volumes were between 0.8 to 127.2 mm3 (median: 28 mm3). Disease free survival (DFS) and local control were calculated on clinical (pain evaluation) and imaging (according to RECIST criteria) follow-up, respectively. Kaplan-Meier method was used for calculation of DFS.
Results: Cryoablation was performed under general (n=15) or local (n=2) anesthesia. Two probes were used in mean (range: 1-4) per procedure. Mean follow-up was 10.3 months (4-27 months). The disease-free survival rates based on clinical evaluation were 82.3% at 6, 12 and 24 months. The rates of local tumour progression based on RECIST criteria were 0% at 6, 12 or 24 months. Eight patients (47%) presented asymptomatic residual tumors surrounding the ablative site on imaging follow-up. Two patients (12%) presented an in situ recurrence. The major complications rate was 5.8% per session (1/17).
Conclusion: Despite high rate of partial ablation, percutaneous image-guided cryoablation appears to be safe and effective for mid-term local control in case of inoperable extra-abdominal desmoid tumors.

B-0889 11:51

Percutaneous cryoablation of lung tumours: one year follow-up
C. Pusceddu; *Cagliari/IT (clapusceddu@gmail.com)*

Purpose: To report the data of one year follow-up with CT-guided percutaneous cryoablation (PCA) in patients with primary and secondary pulmonary tumours.
Methods and Materials: CT-guided PCA was performed on 46 lung masses (18 NSCLC = 39%; 28 metastases = 61%) in 40 consecutive patients not suitable for surgical resection. Lung masses were treated using three types of cryoprobes: IceRod, IceSfere and IceSeed capable of obtaining different size of iceball. After insertion of the cryoprobes into the lesion, the PCA were performed.
Results: All cryoablation sessions were successfully completed. All tumours were ablated. No procedure-related deaths occurred. Morbidity consisted of 20% (8 of 40) pneumothorax, 7% (3 of 40) pleural effusion and 3% (1 of 40) cases asymptomatic small pulmonary haemorrhage, respectively, all of CTCAE grade 1 (Common Terminology Criteria for Adverse Events). Low density of entire lesion, central necrosis and solid mass appearance were identified in 32 (70%), 8 (17%) and 6 (13%) of cryoablated tumours, respectively. Technical success was achieved in 80%, 95%, 91% and 85% of treated lesions at 1-, 3-, 6-, and 12-months CT follow-up scan, respectively. Comparing the tumour longest diameter between the baseline and at 6 and 12 months CT images, technical success was revealed in 91% and 83% cases, respectively.
Conclusion: Cryoablation of the lung tumours is a safe and effective procedure capable of obtaining complete ablation of the tumour in a high number of patients after one year follow-up.

10:30 - 12:00 **Board Room A**

Radiographers

SS 1714

Exploring current issues in medical imaging practice

Moderators:
V. Donoghue; Dublin/IE
N.N.

B-0890 10:30

Best single-slice CT location to measure visceral adipose tissue in children
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Purpose: To investigate the optimal single CT slice location for predicting total abdominal visceral adipose tissue (VAT) volume in children and the relations between anthropometric measurements, gender, age and VAT volume.
Methods and Materials: With ethical permission, 112 abdomen CT scans were retrieved from the PACS systems of paediatric hospitals in Ireland (N= 3), via a random stratified sampling, according to age and gender. VAT area was measured at each intervertebral level between T12 and S1 using Image J analysis software by setting threshold values of -190 to -30 HU and manually segmenting VAT. Abdominal VAT volume was then derived. Waist circumference (WC) and sagittal diameter (SD) were measured at L3-L4 and L4-L5 slices, respectively. Single-slice VAT measurements were correlated with total VAT volume for each slice to identify the optimal slice location for VAT measurements. Regression analysis was used to evaluate WC, SD, age and gender as VAT volume predictors.
Results: Preliminary results have shown that VAT area measured at L4-L5 (r=0.919) was best correlated to abdominal VAT volume in males and at L2-L3 in females (r=0.951). Mean abdominal VAT volume was lower in males (2,443.7 cm^3) than in females (3,490.5 cm^3) although this was not significant (p=0.237). Regression between WC, SD, age, gender and VAT volume showed that waist circumference was most predictive of VAT volume (Beta=1.076, p=0.001).
Conclusion: The optimal slice location for VAT measurements was at L4-L5 in male children and L2-L3 in female children.

B-0891 10:39

Risk factors leading to coronary heart disease within the Maltese population: further factors for consideration

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Purpose: Several cardiovascular risk factors are identified within the literature: age, smoking history, blood pressure and cholesterol levels are the major risk factors leading to coronary heart disease (CHD) (Desai et al, 2004). Many researchers have indicated that these traditional risk factors alone fail to explain the high mortality and morbidity rates associated with CHD, suggesting that underlying risk factors may also be present. This work investigates the risk factors leading to CHD within the Maltese population, as part of an ongoing PhD study.
Methods and Materials: Ethical approval was obtained to review 250 patient medical histories for cardiovascular risk factors within the Maltese population. Primary risk factors were established from a CHD literature search, however risk criteria that are not always taken into consideration such as chronic kidney disease, diabetes and the presence of inflammatory arthritic conditions were also included. The electrocardiogram and myocardial perfusion scintigraphy results in comparison to the results of the Duke risk score were also considered.
Results: The results obtained were compared through regression analysis and the use of IBM SPSS (version 20). Risk factors unique to the Maltese population such as employment type and body mass index were also included. The results were discussed in semi-structured interviews with the Nuclear Medicine physicians and Cardiologists working in Malta to establish a triage system uniquely fitted to these patients.
Conclusion: The triage of patients into appropriate cardiac scintigraphy protocols cannot be exclusively based upon the traditional CHD risk factors established within the literature.

B-0892 10:48

Sex estimation from scapular length measurements by CT scan images in a Caucasian population

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Purpose: Together with race, stature and age, sex is a main component of the biological identity. Thanks to its proportional correlation with parts of the human body, sex can be evaluated form the skeleton. The most accurate approach to determine sex by bone size is based on os coxae or skull. After natural disaster or in archaeological findings, their presence can never be guaranteed. Herein, sexual dimorphism in the human scapula is used to develop a two-variable discriminant function for sex estimation.
Methods and Materials: We have enrolled 100 males and 100 females with a mean age of 64.2 years (SD 12.8 years) who underwent low-dose thoracic CT scan evaluation and we have estimated two scapular diameters: longitudinal scapular length (LSL) and transverse scapular length (TSL). The estimation has been carried out by analyzing images of the scapulae of each patient after three-dimensional post-processing reconstructions.
Results: The two-variable function allows to obtain an overall accuracy of 88% on the calibration sample; using a single scapular parameter accuracy was 84% for LSL and 87% for TSL. Furthermore, we have employed the mentioned function on a collection of 10 Caucasian adult skeletons and sex has been correctly predicted in 9 cases.
Conclusion: In our study, scapula seemed to be a valuable skeletal segment for sex estimation: the two-variable discriminant function provide accuracy of 88% and 90% for the calibration sample and the skeletons, respectively.

B-0893 10:57

Clinical audit in a service of paediatric radiology: preliminary approach

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Purpose: Radiation protection and dose optimisation play key roles in pediatric radiology mainly due to children's high sensitivity to radiation. Clinical audit is a process that aims to improve the quality of healthcare, being essential in a Paediatric Radiology department. The main objective was perform the first step of Clinical Audit in a Radiology Department, evaluating the radiological practice in pediatrics and establishing local Diagnostic Reference Levels (DRL's), allowing analyse a potential optimisation.
Methods and Materials: After selecting the two most common radiological procedures by radiological modality, we performed a retrospective data collection in PACS with 10 patients by procedure and specific age (0, 5, 10 and 15) in order to establish local DRL's based on the 75th percentile of the dose descriptors.
Results: The local DRL's were: 6 mGy.cm2, 38 mGy.cm2, 7 mGy.cm2 and 11 mGy.cm2 for chest radiography (0, 5, 10 and 15 years respectively); 38 mGy.cm2 and 314 mGy.cm2 for pelvis radiography (5 and 10 years); 48 mGy, 50 mGy, 55 mGy and 63 mGy for head Computed Tomography (CT), (0, 5, 10 and 15 years, respectively); 2 mGy 4 mGy for and chest CT (5 and 15 years respectively), and 104 mGy.cm2 for micturating cystourethrography in newborns.
Conclusion: The local DRL's obtained for the chest and pelvis radiography and micturating cystourethrography are in accordance with the ones established in the European level. The majority of the local DRL's in CT are above the levels specified in comparative studies, which indicates a large margin of optimisation of these procedures.

B-0894 11:06

Acoustic noise in MRI

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Purpose: Hearing loss, caused by noise, is one of the 10 most common diseases in the European Union. The acoustic noise in magnetic resonance (MR) is associated with activation and deactivation of the electrical current that induces vibrations in the gradient coils. The noise levels of the safety guidelines of the Food and Drug Administration (FDA) according to measurements should be between 65 and 95 dB. Determine radiographer noise daily personal exposure at work per day (LEX, 8h) and the sound pressure level peak (LCpico). With this values, potential harm from exposure to noise in MR cloud be analysed and prevent and control noise recommendations will be created.
Methods and Materials: The study was divided into three phases: a screening test of acoustic noise with a sonometer, measurements with a dosimeter DC112 in radiographer shoulder during several sequences and measurements during one day daily practice of radiographer.
Results: The daily personal noise exposure at work per day was 75.8 dB (A) and the sound pressure level was 88.4 dB (C). The obtained frequency values are according to FDA Guidelines.
Conclusion: We conclude that the sequences noisiest are the diffusion and the quieter the SPGR. In none of the evaluations to check noise levels higher than those imposed by the Directive No 2003/10/EC of the European Parliament and of the Council of 6 February and Portuguese law 182/2006.

B-0895 11:15

A study of the psychological distress of fMRI volunteers

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Purpose: The majority of MRI patients have experienced some form of distress; distress may compromise the outcome of the examination. Due to the limited data available of the measure of distress amongst fMRI subjects, this study aimed to study the anxiety level of fMRI volunteers.
Methods and Materials: Eighteen volunteers participated in the study. The State-Trait Anxiety Inventory (STAI) was used for data collection. The test was taken pre and post in every fMRI examination to map the volunteers' level of anxiety. The STAI test was supplemented with the measurement of the volunteers' blood pressure and pulse rate pre and post fMRI examinations.
Results: The results of the STAI test revealed the volunteers' tendency for anxiety in general, as well as a measurable state of current anxiety pre and post the fMRI examination. The results of the STAI test pre and post fMRI examination revealed that the subjects' state anxiety level decreased following the fMRI examination in comparison with their level prior to the examination ($p=0.032$. The results of the volunteers' blood pressure showed no significance between the values pre and post examination ($p=0.65$). Decrease of the volunteers' pulse rate following the examination was significant ($p=0.005$).
Conclusion: This study aimed to measure the level of anxiety pre and post fMRI data acquisition since it may influence the outcome of an fMRI examination. The results of the STAI test did not confirm distress amongst the volunteers. This may be attributed to the careful patient preparation prior to the examination.

B-0896 11:24

A European collaborative research study investigating paediatric cardiac interventional radiation dose levels

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Purpose: To investigate examination protocols and radiation dose levels during paediatric cardiac interventional procedures in two European centres.
Methods and Materials: Institutional permission was granted to access imaging records. Retrospective data (n=12 months) was collated in the Irish national centre for paediatric cardiac imaging, performed on a Siemens Bicor unit. Examination data was age categorised: 0 > 1 years, 1> 5 years, 5> 10 years, 10> 15 years, 15> 18 years, and 18+ years. Italian prospective data was collated for five matching cardiac interventional examinations performed using Philips Integris Allura equipment: aortic coarctations; aortic and pulmonary

valvuloplasty procedures, ICD and pulmonary PTA studies. Equipment and protocol details were recorded to include: detector specifications, X-ray beam filtration levels and type, magnification factors applied and routine frame rates during fluoroscopy and image capture.
Results: Irish data for 405 procedures resulted and Italian data for specified procedures is on-going. Comparable additional copper filtration levels of 0.2 mmCu were identified and similar screening rates of 25 fps and magnification factors routinely applied. Preliminary findings indicate Italian examination times are within ranges recorded in the Irish centre, across the five age groupings. DAP levels are comparable, however the 10-15 age grouping recorded higher DAP readings for the bi-plane imaging equipment (Irish centre) compared to the flat panel detector model (Italian centre). Across both centres procedural imaging times generally decreased with increasing patient age.
Conclusion: Initial findings indicate comparable practice and dose outcomes across European paediatric cardiac centres. Further review of imaging protocols and the completed dose data analysis will be presented.

B-0897 11:33

The influence of observer training for the detection of simulated pulmonary lesions on single CT images of an anthropomorphic chest phantom: a jackknife alternative free-response ROC analysis
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Purpose: To determine the influence of both observer training in free-response methodology and simulated lesion appearances on an observer's ability to successfully localise simulated lesions within an anthropomorphic chest phantom on single computed tomography (CT) images.
Methods and Materials: 34 undergraduate radiography students, attending an ERASMUS intensive programme, analysed 46 (31 abnormal containing 1-3 lesions, 15 normal) low-resolution CT images produced primarily for attenuation correction (AC) by two single photon emission computed tomography/computed tomography (SPECT/CT) systems. The evaluation was completed under two conditions, pre- and post-training, with a six-week wash-out period between evaluations. Lesions were localised under the free-response receiver operating characteristic (FROC) paradigm and each evaluation was analysed separately using jackknife alternative FROC (JAFROC) analysis.
Results: JAFROC analysis revealed a statistically significant difference in lesion detection performance between the two sets of low-resolution CT images in both evaluations (pre-training, $F(1,506) = 25.2$, $p < 0.001$; post-training, $F(1.1435) = 32.6$, $p < 0.001$). In addition to offering a slight increase in statistical power, the figure-of-merit (θ) for all treatments was increased from the pre-training evaluation (0.684 (0.573.0.796) and 0.437 (0.334.0.540)) to the post training evaluation (0.784 (0.694.0.875) and 0.560 (0.464.0.655)). The incorrect localisation fraction was also reduced post-training (0.128) compared to pre-training (0.282).
Conclusion: Focussed training of lesion appearances and FROC methodology has a significant impact on a naïve observer's ability to localise simulated lesions on CT images produced with an anthropomorphic chest phantom.

B-0898 11:42

Task shifting towards radiologists in medical imaging: what are the views of the radiographers?
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Purpose: To explore and provide insight about radiographer's opinions in general, and identify influential factors, regarding task shifting towards radiologists and to provide knowledge for further research and work with radiographer's role development in to advanced practice.
Methods and Materials: Qualitative methods based on focus group discussions with 11 radiographers from a medium to large-sized hospital in the health region southeast of Norway. An inductive data analysis was done with a hermeneutic approach in five stages. Results are seen in relation to previous research and the researcher's own experience related to task shifting for radiographers in Norway.
Results: The radiographers in the study express that the most limiting factor for task shift into advanced practice is resistance amongst the radiologists. The radiographers believe that by relieving some advanced diagnostic responsibilities from the radiologists, they can lead to service improvements. However, in spite the negative attitude amongst radiologists towards radiographers taking on diagnostic responsibilities, and the lack of formal support from the department, the radiographers do take decisions regarding justification and clinical follow-up when they feel they have to so in the best interest for their patients.
Conclusion: The radiographers in the study are motivated for task shift towards radiologists, but experience strong resistance in terms of negative attitudes. The study provides knowledge that may be of value in future research and planning of role development processes for radiographers and teamwork in clinical imaging. The study also indicates need for investigation of scope and effect of informal advanced radiographer practice.

B-0899 11:51

Molecular MRI
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Purpose: To introduce the new, innovative and cutting-edge MR technique named molecular-MRI.
Methods and Materials: The molecular-MRI as a high-sensitivity MR technique provides vital information at the cellular or nanomolar level. mMRI is used both for medical diagnostics and for research purposes. Ideal for therapy planning and monitoring/follow-up. Can give precise information about the gene expression and facilitates the examination of cell migration. Very efficient at characterising angiogenesis and brain tumours/its expression levels (VEGFR-2). A recent study evaluates the mMRI differentiation of VEGFR-2 levels in untreated gliomas in a GL261 mouse model. The expression of VEGFR-2 levels was evaluated by using anti-VEGFR2-albumin-Gd-DTPA probe with mMRI. Two separate treatment groups show us different uptake of these levels in tumour region.
Results: Focusing on the study, it confirmed that in vivo VEGFR-2 levels can be monitored as function of therapeutic evaluation. Optimisation is always the key priority.
Conclusion: mMRI offering all these advantages, can help the scientific community to evaluate better the architecture of the 'nano-world' and definitely will be a powerful tool in molecular imaging.

10:30 - 12:00 **Room P**

Contrast Media

SS 1706

New applications and developments

Moderators:
N. Lassau; Villeiuif/FR
A. Wibmer; Vienna/AT

B-0900 10:30

Bile duct evaluation of potential living liver donors with Gd-EOB-DTPA enhanced MRI: should we use single-dose, double dose or half-dose?
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Purpose: Detailed knowledge of the biliary anatomy is essential to avoid complications in living donor liver transplantation. The aim of this study was to determine the optimal dosage of Gd-EOB-DTPA for contrast-enhanced magnetic resonance cholangiography (ce-MRC) with reference to contrast-enhanced CT cholangiography (ce-CTC).
Methods and Materials: 30 potential living liver donors underwent both ce-CTC and ce-MRC. Ce-CTC was performed after drip infusion of meglumine iotroxate. For ce-MRC, ten candidates each received single, double or half-dose Gd-EOB-DTPA. Ce-MRC images with and without inversion recovery pulses (T1w±IR) were acquired 20-30 minutes after intravenous contrast injection. Image data were quantitatively and qualitatively reviewed by two radiologists based on a on a 5-point scale. Data sets were compared using Mann-Whitney-U-test or Wilcoxon-rank-sum-test. Kappa values were also calculated.
Results: All image series provided sufficient diagnostic information both showing normal biliary anatomy and variant bile ducts. Ce-CTC showed statistically significant better results compared to all ce-MRC data sets ($p < 0.001$). T1w ce-MRC with single dose Gd-EOB-DTPA proved to be superior to half and double dose in subjective and objective evaluation without a statistically significant difference (p=033-0.62). Interobserver agreement was good to excellent (k=0.69-0.9).
Conclusion: T1w MRCP after Gd-EOB-DTPA is at any dosage still inferior to meglumine iotroxate-enhanced CTC. Since preoperative planning of bile duct surgery most often is focused on the central biliary anatomy, T1w ce-MRC meets these specific diagnostic demands and allows for replacing harmful ce-CTC strategies. Best results were seen with single dose GD-EOB-DTPA combined with an inversion recovery sequence 20-30 minutes after injection.

B-0901 10:39

Enhancement properties of a high relaxivity macromolecular Gd-based contrast agent (P846) with a standard extracellular Gd-chelat (Gd-DTPA) in rats with experimental liver tumours at 9.4 Tesla

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Purpose: To evaluate the enhancement properties of an experimental Gd-based, high relaxivity, macromolecular contrast agent (P846, Guerbet Research, Aulnay-Sous-Bois, France) in comparison with a standard extracellular Gd-chelate (Gd-DTPA) at 9.4T in a rat model of hepatic colorectal cancer metastases.
Methods and Materials: Nine rats with hepatic metastases were evaluated on a 9.4T MRI unit (Bruker, Germany) acquiring T1w self-gated FLASH sequences (TR/TE=45/2.5 ms, FA=45°, TA=1:23 min, FOV=5.12x5.12 cm2, matrix=256x256) before and at 10 consecutive time points after contrast injection. Each animal received intraindividually both agents at equal doses of 0.1 mmol/kg body weight separated by 48 h. Based on ROI measurements we calculated SNR of normal liver tissue (SNRliver) and tumors (SNRtumor), CNR and lesion enhancement (LE). Statistical analyses included paired t-tests and Wilcoxon tests ($p < 0.05$).
Results: Mean SNRliver, SNRtumor, CNR and LE were significantly higher using P846 as compared with Gd-DTPA (mean (±SD), $p < 0.001$ each): SNRliver: Gd-DTPA 17.3 (±1.2)/P846 24.6 (±1.5), SNRtumor: Gd-DTPA 23.8 (±1.8)/P846 37.2 (±2.0), CNR: Gd-DTPA 6.5 (±0.9)/P846 12.6 (±0.9) and LE: Gd-DTPA 7.9 (±1.8)/P846 13.9 (±2.0) were significantly higher for P846 as compared to Gd-DTPA. Both compounds demonstrated comparable enhancement kinetics with an early peak followed by a gradual washout.
Conclusion: P846 provides significantly better enhancement at 9.4T as compared to Gd-DTPA for equal doses of injected Gd. The large molecular size and subsequent reduced rotational rate of P846 improves the interaction with protons leading to a higher relaxivity. Yet, P846 demonstrates contrast kinetics comparable to those of the extracellular agent during the first 20 min after application in this liver metastases model.
Author Disclosures:
P. Robert: Employee; Guerbet. **A. Buecker:** Research/Grant Support; BMBF (German Ministry of Education and Research, Grant Number: 0314101).

B-0902 10:48

Intraindividual comparison of an experimental high relaxivity extracellular Gd-based contrast agent (P03277) with Gadubutrol in a rat model of hepatic metastases at 9.4 Tesla

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Purpose: To evaluate the enhancement properties of the experimental extracellular Gd-based contrast agent P03277 (Guerbet Research, Aulnay-sous-Bois, France) compared with the commercially available extracellular contrast agent Gadobutrol (Bayer HealthCare, Berlin, Germany) in a model of hepatic colon cancer metastases in rats at 9.4T.
Methods and Materials: 10 rats with hepatic metastases were examined by MRI using a 9.4T animal scanner (Bruker, Germany). Each animal received an intravenous injection of 0.1 mmol/kg body weight (BW) Gadobutrol. Two days later, P03277 was applied at 0.1 mmol/kg BW. T1w self-gated FLASH sequences (TR/TE=45/2.5 ms, alpha= 45°, TA=1:23 min, FOV=5.12x5.12 cm2, matrix:256x256) were acquired before and at 10 time points after contrast injection. SNR of tumor (SNRtumor) and liver tissue (SNRliver), contrast-to-noise ratio (CNR) and lesion enhancement (LE) were calculated based on ROI measurements. Statistical analyses included paired t-test and Wilcoxon tests ($p < 0.05$).
Results: Mean SNRliver, SNRtumor, CNR and LE were significantly higher using P03277 as compared with Gadobutrol at equal doses (mean±SD): SNRliver: Gadobutrol:16.3±4.5 / P03277:21.6±6.1 (p= 0.027). SNRtumor: Gadobutrol:21.8±4.8 / P03277:31.8±6.2 (p=0.003). CNR: Gadobutrol:5.0±2.5 / P03277:9.3±3.3 (p=0.002). LE: Gadobutrol:8.4±5.5 / P03277:16.4±5.3 (p=0.02). Both agents demonstrated an early peak enhancement followed by a continuous washout during the experimental period (20 min).
Conclusion: P03277 demonstrates better contrast enhancement properties as compared to Gadobutrol applied at equal doses (0.1 mmol/kg BW) in this model of hepatic metastases. Based on its high relaxivity P03277 is a highly effective compound for contrast enhanced studies in animal tumor models at 9.4T.
Author Disclosures:
P. Robert: Employee; Guerbet.

B-0903 10:57

Diagnostic imaging after Yttrium 90 therapy in patients with hepatocellular carcinoma (HCC): preliminary comparison of magnetic resonance imaging with Gd-EOB-DTPA and gadobutrol

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Purpose: A precise evaluation of tumour response after Yttrium-90 (Y90) therapy is essential for adequate clinical management. However, evaluation of imaging may be hampered as Y90 itself can lead to reactive liver changes with similar appearance to progress. We compared liver MRI using a liver specific contrast agent (Gd-EOB-DTPA) gadobutrol-enhanced liver MRI concerning therapy response evaluation.
Methods and Materials: 20 patients with HCC underwent contrast-enhanced computed tomography (CT) and gadobutrol MRI on the day before and Gd-EOB-DTPA MRI directly before Y90 therapy. Follow-up images were performed 30, 90 and 180 days after therapy. Two radiologists reviewed the gadobutrol and Gd-EOB-DTPA enhanced liver MR images in consensus. They rated therapy response using a 4-point-scale: 1=definitely response, 2=probably response, 3=probably no response, 4=definitely no response. CT in combination with laboratory parameters served as reference standard.
Results: CT and laboratory parameters revealed progress in 5 patients after 30, 3 patients after 90 and 7 patients after 180 days. With Gd-EOB-DTPA MRI radiologists were more determinate compared to gadobutrol-MRI (mean values day 30 for responders with Gd-EOB-DTPA=1.4; gadobutrol=1.9). In one patient each on day 90 and 180 radiologists rated gadobutrol-MRI as probable response while Gd-EOB-DTPA MRI revealed definite progress which was confirmed by Alpha- fetoprotein levels.
Conclusion: Gd-EOB-DTPA MRI allows for a more precise assessment of tumour response after Y90 therapy. The liver specific contrast agent enabled earlier diagnosis of tumour progress compared to gadobutrol MR and also to CT and can differentiate between therapy-induced changes and real tumour progress.

B-0904 11:06

Use of high-relaxivity paramagnetic complex Mn-DCTA as contrast agent for simultaneous MR-coronarography and contrast-enhanced MRI of the heart

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Purpose: The complex of manganese with trans-1, 2-diaminocyclohexane- N, N, N', N'-tetraacetate (Mn-DCTA, ™Cyclomang) was tested as possible contrast agent for simultaneous MR-coronarography and ECG-gated contrast-enhanced MRI of myocardium.
Methods and Materials: 21 patients with three-vessel coronary heart disease comprised the study group and seven persons with normal coronary arteries and minor left ventricle hypertrophy due to arterial hypertension were recruited to control one. ECG- and breath-synchronised ssfp-coronarography has been carried out in everybody for thr right coronary (RCA), left anterior descendent (LAD) and left circumflex (LCx) coronary arteries. Also the CE-MRI of the heart was performed in everybody. In all patients, the diagnosis was verified with coronaroventriculography.
Results: The R1 relaxivity of Mn (II)-DCTA measured in saline as high as R1=3.68 mM-1*s-1 did not differ significantly from the values obtained with gadopentetate. The senisitivity of Mn-DCTA enhanced MR-coronarography was, respectively, as high as: RCA 87%, LAD 92% and LCx89%. The specificity was for the particular coronary arteries as follows: RCA 81%, LAD 86% and Lcx82%. The subsequent CE-MRI of the heart detected the areas of non-transmural ischaemic myocardial damage for all walls of LV with equivalent 98% sensitivity and 96% specificity. Both sensitivity and specificity in transmural infarctions were 98.8%.
Conclusion: The non-gadolinium paramagnetic agent Mn-DCTA could be suggested as acceptable contrast for complex "one-stop-shop" MRI evaluation of both coronary vessels and myocardial ischaemic damage, without risk of gadolinium toxicity.

B-0905 11:15

Can Ferumoxytol be used as a contrast agent to differentiate between acute and chronic inflammatory kidney disease? Feasibility study in a rat model

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Purpose: Ferumoxytol, an intravenous iron supplement, can be used as a contrast agent in magnetic resonance imaging (MRI). Aim of this study was to assess Ferumoxytol in animal models of acute and chronic inflammatory kidney diseases.
Methods and Materials: A total of 18 rats were examined: 6 healthy Sprague Dawley rats as a control group; 6 rats with polycystic kidney disease (PKD) as a model for chronic inflammatory disease; Thy-1, a antibody that triggers glomerulonephritis was injected in 6 rats as a model for acute inflammation. Each rat was examined using a clinical 3 T scanner (Magnetom Trio, Siemens) and a dedicated rat coil (Rapid Biomedical) directly before and 24 hours after intravenous administration of Ferumoxytol. Changes in relative T2 signal intensity and T2*-times were measured. The rats' kidneys were histologically examined.
Results: In the evaluation of the MRI scans, statistically significant differences between the three groups were found: Thy-1 rats showed the highest T2 signal loss in the renal cortex (T2 signal intensity ratio after/before: Thy1 0.49, PKD 0.87, control 0.81; p=0.038). Thy1 and PKD rats showed statistically significant changes of T2*-times compared to the control group (T2*-time ratio after/before: Thy1 0.21, PKD 0.19, Control 0.28; p=0.002). MRI findings were confirmed by histological analyses: statistically significant differences in Ferumoxytol particle count between the three groups were found.
Conclusion: Ferumoxytol-enhanced MRI allows detecting acute and chronic inflammatory kidney disease with typical patterns of Ferumoxytol distribution. Ferumoxytol thus might help to differentiate between different types of inflammation in various kidney diseases.

B-0906 11:24

Solid phase peptide synthesis (SPPS) combined with the inverse Diels-Alder reaction: a versatile tool for novel theranostic applications

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Purpose: Development of novel diagnostic approaches in imaging of molecular processes at the transcription level and synthesis of pharmacologically active patient-specific metabolic components requires high standards of safety, quality, and specificity but also, rapid, efficient and irreversible ligation routes. Here, we assessed the applicability of the inverse Diels-Alder ligation reaction with inverse electron demand (DARinv) for improved synthesis of novel diagnostic and therapeutic agents.
Methods and Materials: We synthesized using SPPS a fluorescent dye conjugate composed of a cell-penetrating peptide (CPP) facilitating the passage across the cell membrane by "Click chemistry" ligation of the CPP carrier and the fluorescent cargo component similar to Cy5. DU-145 and PC-3 cells were incubated for 15 minutes with the conjugate (12.5 µM final concentration), co-stained with DAPI and wheat germ agglutinin (WGA) and investigated using CLSM for the detection of fluorescence signals.
Results: After incubation with the Cy5-labelled conjugate, both PC-3 and DU-145 human prostate cancer cells revealed strong fluorescence signal in the cytoplasm and in the perinuclear areas. Specific signals were observed as dot-like areas scattered in particular in the proximity of the cell membrane as visualised by WGA-staining (labeling membrane glycoproteins and glycolipids).
Conclusion: DARinv is an eligible ligation technology not only for prospective medical applications e.g. patient-specific approaches, but also for selective modification by functionalization of peptide-based polymers, organic and inorganic surfaces and micro arrays. We conclude that ligation technology based on DARinv has a high potential of becoming an important approach for easier and faster molecular diagnostics and patient-specific therapy.

B-0907 11:33

Magnetic particle imaging (MPI): kinetics of the intravascular signal in vivo

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Purpose: In magnetic particle imaging (MPI) image quality is determined by the properties of the used superparamagnetic iron oxide nanoparticles (SPIOs); thus, a long blood half-life of the SPIOs is desirable. The aim of this study is to evaluate the blood half-life of the Resovist-induced MPI-signal.
Methods and Materials: A dilution of Resovist (50 µmol/kg) was administered into the ear artery of ten fully anaesthetised New Zealand white rabbits. Blood samples were drawn before and directly, 5, 10, 15 min and then every 15 min after Resovist administration. Every blood sample was evaluated using magnetic particle spectroscopy. The decay of the MPI signal was calculated for each time point.
Results: The highest spectral MPI signal was measured directly after Resovist® administration (1.79*10^-8 Am^2 Hz^-1). After application of Resovist the signal decreased to 30.0 % within 5 min and to 14.8 % and 7 % within 10 and 15 min, respectively. Within 30 min, the measured signal was below the background noise level.
Conclusion: The decrease of the intravenous signal is faster than the blood half-life of Resovist determined by MRI. This might be explained by the faster blood-clearance of the fraction of larger particles and particle aggregates contributing to the better part of the MPI-signal in comparison to the smaller particles which only contribute a small part of the MPI-signal. Additionally, because of the higher sensitivity of the MPS-system compared to the current MPI-scanners, the visualisation of blood vessels will be possible for an even shorter time period.

B-0908 11:42

Comparative in vitro dissociation of gadolinium chelates in human serum measured by relaxometry

N. Fretellier, J.-M. Idee, G. Jestin-Mayer, M. Rasschaert, C. Factor, C. Corot; *Roissey-Charles-de-Gaule/FR (ideej@guerbet-group.com)*

Purpose: Assessment of the stability of all marketed categories of gadolinium chelates (GC), in human serum at 37 °C.
Methods and Materials: GCs gadoterate (Dotarem®), gadopentetate (Magnevist®), gadobenate (MultiHance®) and gadodiamide (Omniscan®) (1 mM) were incubated in human serum for 15 days, with or without addition of 10 mM phosphate, at 37 °C. Relaxation times T_1 were measured (Minispec mq60 Bruker relaxometer) at 60 MHz. Relaxation rates R_1 (s^{-1}) were calculated ($R_1=1/T_1$). The influence of serum proteins on gadodiamide dissociation was investigated by ultrafiltrating the samples.
Results: A marked increase in the R_1 relaxation rate value over the time was observed only after incubation of gadodiamide in serum (+49 %/+78% at day 15 without/with phosphate, *versus* T0), suggesting a gradual dissociation for this GC. After incubation of gadopentate or gadobenate, a slight increase in R_1 value was also observed. This increase in R_1 value was greater and faster after adjustment of phosphate concentration to 10 mM (+5%/+9% and +9%/+14%, without/with phosphate, respectively, at day 15). For the macrocyclic GC gadoterate, R_1 values remained stable throughout the study, indicating the absence of dissociation. Serum ultrafiltration completely inhibited gadodiamide-induced increase in R_1 value.
Conclusion: Our data indicate a gradual *in vitro* dissociation with gadodiamide and binding of dissociated and soluble Gd^{3+} to serum proteins (an effect facilitated by phosphate anion). The macrocyclic GC gadoterate remained stable over 15 days.
Author Disclosures:
N. Fretellier: Employee; Guerbet. **J. Idee:** Employee; Guerbet. **G. Jestin-Mayer:** Employee; Guerbet. **M. Rasschaert:** Employee; Guerbet. **C. Factor:** Employee; Guerbet. **C. Corot:** Employee; Guerbet.

B-0909 11:51

TOF MRA versus ultra-low-dose contrast-enhanced MRA at 7T

L. Umutlu, A. Fischer, M. Forsting, M. Ladd, S. Maderwald, O. Kraff, T.C. Lauenstein; *Essen/DE (Lale.Umutlu@uk-essen.de)*

Purpose: The aim of this trial was to compare the diagnostic ability of non-enhanced (TOF) versus ultra-low-dose contrast-enhanced renal MRA at 7 Tesla.
Methods and Materials: 10 healthy subjects were examined on a 7T MR system (Magnetom 7T), utilising a custom-built 8-channel RF body coil. For non-enhanced renal MRA Time-of-flight (TOF) datasets with a voxel size of 1.0 x 2.0 x 2.5 mm3 were obtained. For ultra-low-dose contrast-enhanced (ce) renal MRA, dynamic 3D FLASH data sets (voxel size 1.0 x 1.5 x 1.0 mm3) were obtained unenhanced and in arterial phase after the application of 0.025 mmol/kg BW Gadobutrol (Bayer Healthcare). Image subtraction was performed subsequently. Contrast ratios (CR) were measured in the aorta and both renal arteries in correlation to adjacent psoas major muscle. Qualitative analysis with regard to delineation of the renal arterial vasculature was performed by two radiologists using a five-point-scale (5=excellent to 1= non diagnostic).
Results: vasculature. Qualitative analysis revealed comparable results of vessel conspicuity in subjective ratings for non-enhanced (mean left renal artery = 4.4) and subtracted contrast-enhanced datasets (mean left renal artery = 4.7). Background suppression in subtracted datasets was superior to background suppression of TOF-images, reflected in superior contrast ratio values for subtracted datasets (mean aorta =0.74) compared to TOF-MRA (mean aorta = 0.45).

Conclusion: Preservation of high-image quality while facilitation of significant reduction, or respectively complete omission of contrast agent, may be of high diagnostic value for MR angiographic examinations in patients with renal impairment.

14:00 - 15:30 **Room A**

Cardiac

SS 1803
Myocardial perfusion and late enhancement: CT

Moderators:
G. Balázs; Budapest/HU
E. Mershina; Moscow/RU

B-0910 14:00

Incremental value of pharmacological stress dual-energy cardiac CT over coronary CT angiography alone for the assessment of coronary artery disease in a high-risk population

C. De Cecco, U.J. Schoepf, A.W. Krazinski, A. Bucher, A.D. McQuiston, F.G. Meinel; *Charleston, SC/US (carlodececco@gmail.com)*

Purpose: To prospectively determine the value of stress dual-energy CT (DECT) myocardial perfusion imaging to coronary CT angiography (cCTA) for the assessment of coronary artery disease (CAD) in a high-risk population.
Methods and Materials: We prospectively enrolled 29 consecutive patients who were referred for cardiac SPECT examinations for known or suspected CAD to additionally undergo pharmacological stress cardiac DECT. In 25 patients cardiac catheterization was available as the reference standard for morphologically significant stenosis. The performance of CCTA alone, DECT myocardial perfusion alone and the combination of both was assessed by calculating sensitivity, specificity and area under the curve (AUC) values.
Results: For morphologically significant stenosis, cCTA alone and myocardial DECT assessment alone had 95% sensitivity and 50% specificity. The combined approach yielded 100% sensitivity at 33% specificity if either was positive and 90% sensitivity at 67% specificity if both were positive. The AUC value was highest (0.78) if both were positive. For hemodynamically significant lesions, cCTA alone had 91% sensitivity at 38% specificity and DECT alone had 95% sensitivity and 75% specificity. The combined approach yielded 100% sensitivity at 38% specificity if either was positive and 86% sensitivity at 75% specificity if both were positive. AUC values were highest for DECT alone (0.85) and the "both positive" evaluation (0.80).
Conclusion: The combined analysis of cCTA and DECT myocardial perfusion reduces the number of false positives in a high-risk population for CAD and outperforms the purely anatomical test of cCTA alone for the detection of morphologically and hemodynamically significant CAD.

B-0911 14:09

Quantitative analysis of dynamic CT myocardial perfusion imaging in a large, multi-center patient population

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Purpose: To determine the accuracy of quantitative measurements of myocardial blood flow (MBF), myocardial blood volume (MBV) and volume transfer constant (K_{trans}) derived from stress dynamic CT myocardial perfusion (CTMP) imaging to differentiate between myocardium with and without perfusion defects.
Methods and Materials: We retrospectively analysed CTMP datasets from 146 patients from 5 centres who underwent coronary CT angiography (CCTA) and CTMP imaging. CCTA datasets were evaluated for the presence of coronary stenosis on a per-vessel basis. In correlation with the CCTA, CTMP datasets were visually evaluated for perfusion defects in each vessel territory. For the quantitative analysis, regions of interest were placed in the myocardium of each vessel territory to obtain MBF, MBV and K_{trans}.
Results: The areas under the receiver operating characteristic curves (AUCs) to discriminate between vessel territories with and without perfusion were 0.964 for MBF, 0.967 for MBV and 0.849 for K_{trans}. The optimal cutoffs were ≤88 mL/100 mL/min for MBF, ≤15 mL/100 mL for MBV and ≤69 for K_{trans}. Sensitivity and specificity for myocardial perfusion defects were 93% and 98% for MBF and 95% and 91% for MBV, respectively.
Conclusion: MBF and MBV measurements on dynamic CT myocardial perfusion imaging can differentiate between myocardial territories with and without perfusion defects with high discriminatory power.
Author Disclosures:
U.J. Schoepf: Consultant; Bayer, Bracco, GE, Medrad, Siemens.

B-0912 14:18

Evaluation of accuracy for detection and extent of occult myocardial scars using delayed-enhancement CT in patients with asymptomatic diabetes: results from the ACCREDIT study

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Purpose: To evaluate the accuracy of delayed-enhancement CT (DE-CT) for detecting occult myocardial scars (OMS) and to evaluate the transmurality of OMS using DE-CT compared with delayed enhancement MRI (DE-MRI) in asymptomatic patients with type 2 diabetes.
Methods and Materials: DE-MRI and DE-CT were respectively performed with gadoterate meglumine and Iobitridol on 167 patients. Image quality of DE-CT was evaluated. The prevalence and the transmurality of OMS on both DE-MRI and DE-CT at patient level and segment level were evaluated. The accuracy of DE-CT for detecting OMS was evaluated in comparison with DE-MRI both at patient and segment level. The transmurality of OMS in DE-CT and DE-MRI for each scar was assessed in terms of over- or underestimation of DE-CT.
Results: The image quality of DE-CT was good and adequate in 165 (98.8%) patients. The OMS was detected in 12 (7.3%) by DE-MRI and 7 (4.3%) by DE-CT. Of the 2788 segments, OMS was detected in 24 segments on DE-MRI and in 12 segments on DE-CT. The sensitivity, specificity, positive and negative predictive value of DE-CT for detecting OMS was 58.3%, 100%, 100%, and 96.8% at patient level, and 50%, 100%, 100%, and 99.6% at segment level. The grade for transmurality of OMS between DE-CT and DE-MRI was matched at segment level in 41.7%, under-evaluation of transmurality on DE-CT was in 54.2%.

Conclusion: The sensitivity of DE-CT for detecting OMS is moderate, but the specificity is high. Under-evaluation of the transmurality of OMS is common using DE-CT.
Author Disclosures:
J. Kang: Research/Grant Support; Guerbet Group, France. **S. Choi:** Research/Grant Support; Guerbet Group, France. **S. Ko:** Research/Grant Support; Guerbet Group, France. **T.-H. Lim:** Research/Grant Support; Guerbet Group, France.

B-0913 14:27

Quantitative evaluation of novel beam-hardening artefact correction technique in dual-energy CT perfusion imaging of the myocardium

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Purpose: In cardiac dual energy CT (cDECT) perfusion imaging, contrast medium filling of the left ventricle and descending aorta and the spine are relevant sources of beam-hardening artefacts (BHA) impeding diagnostic evaluation of myocardial regions for perfusion defects. The purpose of this study was to quantitatively assess the impact of a novel Kernel (D33f) with implemented beam hardening correction on BHA of the myocardium.
Methods and Materials: Rest series of cDECT perfusion examination from 14 patients were retrospectively analysed. Six reconstructions were performed for each patient with 3.0 mm section thickness: a) 100 kV b) 140 kV c) mixed image, each with (D33f) and without (D30f) BHA correction kernel. 792 myocardial regions of rest studies were compared. Regions of interest (ROI), traced by a reader, equally subdivided the myocardium in the axial slice where BHA was most visually prevalent. This individual ROI mask was copied onto all corresponding series. Three subdivisions were made within areas of BHA. Paired student t-test was used for statistical evaluation.
Results: Myocardial attenuation significantly differed on corrected reconstructions (D30f 85.1 HU ± 82.9-87.3; D33f 89.2 HU ± 87.0-91.4, $p < 0.001$). Relative difference from average myocardial attenuation significantly differed within visually chosen ROIs (D30f 21.9% ± 18.6-25.2%; D33f 11.1% ± 9.3-12.8% $p < 0.001$). RD™ difference was greatest for BHA occurring in the infero-lateral basal myocardium (D30f 30.7% ± 26.5-34.9%; D33f 11.5% ± 8.7-14.3% $p < 0.001$).
Conclusion: D33f kernel application in post-processing of cDECT perfusion studies can significantly reduce BHAs, improving myocardial perfusion defect assessment.
Author Disclosures:
U.J. Schoepf: Research/Grant Support; Bayer, GE, Bracco, Medrad, Siemens.

B-0914 14:36

CT evaluation of myocardial extracellular volume in patients with chronic myocardial infarction: a novel approach for objective assessment of myocardial viability

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Purpose: Myocardial viability is commonly evaluated by assessing extent of delayed enhancement (DE) which depends on choice of threshold value. CT assessment of extracellular volume (ECV) is a new approach towards quantitative evaluation of myocardial scar. The purpose of this study was to investigate if ECV quantified in each myocardial segment could be used for objective assessment of myocardial viability.
Methods and Materials: Pre-contrast and delayed-phase CT were obtained in 20 patients with chronic myocardial infarction by using a dual-source CT. Delayed-phase CT was reconstructed with a targeted spatial frequency filtration (TSFF) algorithm to obtain stable attenuation of the myocardium. ECV was calculated with the following equation: $ECV=(\Delta HUm / \Delta HUb)\cdot(1-Hct)$, where ΔHUm and ΔHUb is the change in attenuation of the myocardium and the LV blood, respectively, before and after contrast administration. Extent of DE by visual assessment and ECV were determined in each of 16 myocardial segments.
Results: There was a significant segment-based linear relationship between extent of DE and ECV ($y=0.20x+27.0$, $r^2=0.58$), with ECV of 27%, 32%, 37% and 42% corresponding to DE extent of 0%, 25%, 50% and 75%, respectively. ROC curve analysis demonstrated AUC of 0.962 for detecting segments with DE of >= 50%, with sensitivity of 91% and specificity of 92% with threshold ECV of 34.5%. High inter-observer reproducibility was found in measuring ECV, with intraclass correlation coefficient of 0.898.
Conclusion: Accurate and objective assessment of myocardial viability can be performed by using ECV determined by dual-source CT with TSFF algorithm in patients with chronic myocardial infarction.
Author Disclosures:
H. Sakuma: Research/Grant Support; Siemens Japan, Bayer.

B-0915 14:45

Diagnostic accuracy of late iodine enhancement on cardiac DSCT with denoise filter in the evaluation of myocardial infarction

T. Matsuda[1], T. Kido[1], T. Itoh[2], S. Shigemi[3], H. Saeki[3], K. Watanabe[3], T. Matsuda[3], M. Yamamoto[3], T. Mochizuki[1]; [1]*Toon/JP*, [2]*Tokyo/JP*, [3]*Matsuyama/JP*

Purpose: We evaluated diagnostic accuracy of the late myocardial enhancement (LME) on a dual-source CT (DSCT) with both a denoise filter and an improved injection protocol (LIE-CT), by comparing with the late gadolinium enhancement on MRI (LGE-MR).
Methods and Materials: In 18 patients with acute myocardial infarction, DSCT and 1.5 T MRI were performed within 3 weeks. After the coronary CTA, an additional contrast medium with a slow injection rate (50 ml, 12 ml/min) was added, and then the LIE-CT was performed. To reduce image noise, we applied an iterative 3D denoise filter to LIE-CT images. Detectability of LME with LIE-CT and LGE-MR was compared. Infarct area was assessed as percentage of the myocardium. The CT value ratios were calculated as contrast enhancement of myocardium divided by that of left ventricular cavity.
Results: LME was detected in 17/18 patients in LGE-MR and 15/17 patients in LIE-CT. LIE-CT areas (mean=9.4%) correlated well with those of LGE-MR (mean=10.3%). Mean CT values of normal and infarction areas were 75.4 ± 12.5 HU and 108.12 ± 19.1 HU, respectively. Mean CT value ratios of the normal and the infarction areas were 0.45 ± 0.16 and 1.09 ± 0.56, respectively. Mean CT value and mean CT value ratio of the infarction areas were significantly higher than those of the normal areas, respectively ($p < 0.001$).
Conclusion: Late myocardial enhancement areas on both DSCT and MRI are correlated well. DSCT with the denoise filter and the additional slow contrast medium injection protocol can improve the diagnostic accuracy.
Author Disclosures:
T. Itoh: Employee; Siemens Japan.

B-0916 14:54

Myocardial dynamic perfusion imaging with DSCT: a comparative study with magnetic resonance imaging

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Purpose: To evaluate the feasibility of adenosine-stress dynamic myocardial volume perfusion imaging with second generation dual source computed tomography (DSCT) for the qualitative and quantitative assessment of myocardial blood flow (MBF) compared with stress perfusion and viability magnetic resonance imaging (MRI).
Methods and Materials: Prospective study including 13 patients (10 male, 3 female, mean age 61.2 ± 8.69 years) who underwent stress/rest perfusion and delayed-enhancement MRI, and a cardiac DSCT protocol: 1. Dynamic adenosine-stress myocardial perfusion imaging using a "shuttle" mode
2. Coronary CT angiography. 3. Delayed enhancement acquisitions. Two independent observers visually assessed myocardial perfusion defects and quantified perfusion values of segments with and without defects.
Results: A total of 221 segments were analysed. Sensitivity, specificity, positive and negative predictive values for detection of myocardial perfusion defects at CT compared with MRI were 63%, 99%, 85%, and 96%, respectively. Quantitative assessment showed myocardial blood flow values of 82.4 ± 26.2 ml/100 ml/min and 125.3 ± 43.6 ml/100 ml/min for ischemic and nonischemic segments respectively, existing significant differences. Mean total dose length product for the entire cardiac CT protocol was 9.85 ± 2.5 mSv.
Conclusion: DSCT is able to obtain qualitative and quantitative images of dinamic myocardial perfusion. Diagnostic accuracy is acceptable, although with lower sensibility values compared with other publications, specially in the study of myocardial viability. More studies are needed to set the real diagnostic accuracy of this technique.

B-0917 15:03

Early myocardial gadolinium enhancement in patients with myocarditis: validation of "Lake Louise consensus" criteria using a single bolus of 0.1 mmol/Kg of a high relaxivity gadolinium-based contrast agent

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Purpose: Early gadolinium enhancement (EGE) has been indicated as major CMR criterion for the diagnosis of myocarditis according to the Lake Louise consensus (LLC). However, the suggested threshold of 4.0 for early enhancement ratio (EER) specifically refers to use of conventional Gd-chelates (gadopentetate dimeglumine). Our purpose was to evaluate performance of a high relaxivity contrast agent (gadobenate dimeglumine) for the detection of EGE applying the suggested cut-off.
Methods and Materials: Fifty-seven consecutive patients with a histologically proven diagnosis of acute myocarditis and 18 controls performed a CMR study on a 1.5 T unit. CMR protocol included: T2w-STIR sequences, early gadolinium enhancement (EGE) and late gadolinium enhancement (LGE) technique after a single bolus of 0.1 mmol/Kg Gd-BOPTA. For each study early myocardial enhancement ratio was calculated as follows: early gadolinium enhancement ratio = enhancement myocardium/enhancement skeletal muscle. In patients with evidence for skeletal muscle involvement, an absolute myocardial enhancement of more than 45% was considered as diagnostic criterion. Receiver operating characteristic (ROC) curve analysis was applied on the overall population.
Results: EGE was present in 35 patients with myocarditis. Applying the EGE threshold proposed by LLC (EER value> 4.0) to the ROC curve, sensitivity and specificity of, respectively, 60.7% and 88.9% (area under curve: 0.722) were observed. These results are comparable to those obtained using gadopentetate dimeglumine reported in literature.
Conclusion: Use of Gd-BOPTA provides comparable results to conventional Gd-chelates regarding the application of EGE suggested thresholds for the diagnosis of acute myocarditis and it is therefore applicable in daily clinical routine.

B-0918 15:12

Comparison between unenhanced and contrast-enhanced post-mortem CT for diagnosis of death by cardiovascular events at virtual autopsy

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Purpose: To evaluate the value of contrast-enhanced post-mortem CT in comparison to non-enhanced post-mortem CT in the detection of cardiovascular causes of death and the clinical value of the method.
Methods and Materials: In a prospective study, 21 corpses were examined using multislice computed tomography before and after intraarterial perfusion contrast agent with a CT-value of 300 HU and ventilation of the lungs. CT-values were measured in the following locations: left ventricle, descending aorta, common carotid arteries, common iliac arteries and popliteal arteries. The cause of death was determined in enhanced and unenhanced scans and a level of confidence was given. Results were compared to autopsy results as gold standard.
Results: Intraarterial perfusion resulted in a very homogeneous arterial contrast enhancement with equally 300 HU in every of the mentioned locations. No extravasation due to methodical failures or shunting into the venous system occurred. The method allowed visualisation of different types of cause of death. Unenhanced and enhanced scans were compared and the results compared to those of conventional autopsy. There was a significant improvement in LOC in enhanced scans compared to unenhanced scans as well as an improvement in the detection of COD.The ventilation of the lungs

inflated and distended the thorax, making diagnoses easier. The COD could be determined in 20 out of 21 patients.
Conclusion: Post-mortem contrast-enhanced CT is feasible and appears to be robust for diagnosing cardiovascular causes of death. When compared with unenhanced post-mortem CT intraarterial perfusion and pulmonary ventilation significantly improve visualisation and diagnostic accuracy.

B-0919 15:21

Diagnostic accuracy of myocardial perfusion assessment using computed tomography in comparison to SPECT and ICA: a meta-analysis
G. Pelgrim, X. Xie, M.D. Dorrius, A. Handayani, M. Den Dekker, M. Oudkerk, R. Vliegenthart; *Groningen/NL (gjpelgrim@gmail.com)*

Purpose: To determine the diagnostic accuracy of perfusion computed tomography (CT) in rest and stress for the detection of significant coronary artery disease (CAD), using single photon emission computed tomography (SPECT) and invasive coronary angiography (ICA) as a reference standard.
Methods and Materials: Pubmed, Embase and Web of Knowledge were searched until March, 2013. Two reviewers independently screened 5,110 records regarding diagnostic accuracy of CT perfusion in rest and stress, based on title and abstract. Two reviewers then assessed the full-text of the resulting 390 studies for inclusion and extracted information. True-positive, true-negative, false-positive and false-negative numbers were extracted for diagnostic performance. The studies were grouped according to CT perfusion technique and reference method. Patient-based results were pooled using a random effects model. Statistical analysis required at least 4 studies using equal methodology to be included.
Results: In total, 11 studies (744 participants) of the total 5,110 were included. For rest CT perfusion, 6 out of these 11 studies were pooled (457 participants). Pooled sensitivity and specificity for ischaemia was 0.87 (0.77, 0.93) and 0.88 (0.79, 0.94) compared to rest SPECT. Regarding stress CT perfusion, 5 out of the 11 studies were pooled (287 participants) with ICA as reference standard. Pooled sensitivity and specificity for stress CT perfusion was 0.86 (0.64, 0.95) and 0.90 (0.57, 0.98) compared to ICA.
Conclusion: CT perfusion techniques and reference standards vary in current literature. Based on limited studies, CT perfusion techniques seem sensitive and specific for diagnosis of significant CAD compared to ICA and SPECT.

B-0920 15:30

Comparison study of the rest and adenosine stress of myocardial between CT perfusion and SPECT in CHD
S. Ou, S. Li, s. Ou, F. Long, H. Lin; *Guangzhou/CN (oushanxing@sina.com)*

Purpose: The aim of this study was to determine the agreement of adenosine stress CTP and SPECT-MPI under rest and stress including every segment and vessel in CHD.
Methods and Materials: 47 patients underwent a nuclear stress test in 3 months in the study. DECT was performed as follows: 1. stress CT of contrast-enhanced scan during adenosine infusion. 2. rest CT of contrast-enhanced scan by prospective triggering. Perfusion defect was graded as transmural (> 50%) versus nontransmural (< 50%). CTPI and SPECT were completed by 2 independent and 5 years experienced radiologists.
Results: 47 subjects (average age 61.4± 10.7 years; An average radiation dose of 12.7 mSv of per CTP. CTP had a sensitivity of 78% and a specificity of 81% for the vessel stenosis of ≥50%, whereas SPECT myocardial perfusion imaging had a sensitivity of 66% and a specificity of 83% (P=0.442 in sensitivity, P=0.864 in specificity). When stenosis of ≥70% by CTA was used as the reference standard,the sensitivity and specificity were 84% and 68% by CTP, but 71% and 73% by SPECT (P=0.564 in sensitivity, P=0.688), respectively.
Conclusion: Adenosine stress CTP can identify the accuracy of stress-induced myocardial perfusion defects compared to SPECT and provide more information on coronary stenosis in CHD.

14:00 - 15:30 **Room B**

Abdominal Viscera

SS 1801a
Advances in CT

Moderators:
S.T. Schindera; Basle/CH
J. Votrubova; Prague/CZ

B-0921 14:00

Sequential contrast-enhanced CT analysis of reduction effect on multicentric type recurrence of HCC with Peretinoin
S. Kobayashi, T. Gabata, O. Matsui, W. Koda, T. Minami, K. Kozaka, A. Kitao, N. Yoneda, K. Yoshida; *Kanazawa/JP*

Purpose: To evaluate the reduction of multicentric type recurrence (MC recurrence) with Peretinoin, an acyclic retinoid, in patients previously treated for HCC with sequential contrast-enhanced CT (CECT) images.
Methods and Materials: After curative resection or ablation for HCC, patients received either Peretinoin 600 mg/day (the high-dose group, H), 300 mg/day (the low-dose group, L) or placebo (P). Total 210 cases showed recurrence of HCC (H, 53; L, 80; P, 77) during follow-up period. Among the recurrent hypervascular HCCs, nodules which appeared in the point where hypovascular hepatic nodules were previously observed and regarded to be multistep hepatocarcinogenesis on follow-up sequential CECT images are defined to be MC recurrence of HCC. The cumulative MC recurrence free survival (MCRFS) rates were calculated. Hazard ratio (HR) was calculated using Cox regression analysis.
Results: MC recurrence occurred in 43 cases (H n=6; L, n=18; P, n=18). MCRFS rates in H were higher than those in P or L (during the first year, H, 95.8%; L, 93.6%; P, 94.2%: during the 2 years, H, 90.1%; L, 86.0%; P, 81.4%: during the 3 years, H, 90.1%; L, 78.2%; P, 69.5%). No events occurred in H after 2 years of enrollment. The HR (H vs. P) for 3 years ≤ was 0.41 (95% CI, 0.16 to 0.93). The HR (L vs. P) for 3 years ≤ was 0.99 (95% CI, 0.51 to 1.92).
Conclusion: Analysis of sequential CECT could show that Peretinoin 600 mg/day reduced the MC recurrence of HCC.
Author Disclosures:
O. Matsui: Advisory Board; KOWA Company, LTD.

B-0922 14:09

Effect of reconstruction algorithm on semi-automated quantification of liver lesion size and density at MDCT
V. Yaghmai, F.D. Gonzalez-Guindalini, A.R. Seyal, K. Parekh; *Chicago, IL/US (v-yaghmai@northwestern.edu)*

Purpose: To evaluate the effects of Filtered Back Projection (FBP) and Sinogram Affirmed Iterative Reconstruction (SAFIRE) on liver lesion size and density using semi-automated quantification.
Methods and Materials: This HIPAA compliant retrospective study was IRB approved. Fifteen oncology patients with 30 hypodense liver metastases who had undergone a CT scan of the abdomen and pelvis were evaluated. The scans were simultaneously reconstructed using two different algorithms: Filtered Back Projection (FBP - Protocol 1) and Sinogram Affirmed Iterative Reconstruction (SAFIRE - Protocol 2). Lesion largest diameter (RECIST), bi-dimensional diameters (WHO) and volume, as well as the whole lesion density were obtained using semi-automated software and were compared. Wilcoxon signed-rank test was used for analysis. $P < 0.05$ was considered significant.
Results: Lesion size measurements did not change between different reconstruction algorithms. The median largest diameters for protocols 1 and 2 were 2.3 cm (IQR: 1.4) and 2.3 cm (IQR: 1.4) (P=0.55). The bi-dimensional measurements were 3.9 cm^2 (IQR: 4.9) and 3.8 cm^2 (IQR: 5) for protocols 1 and 2, respectively (P=0.7). Volumetry was also comparable between protocol 1 and protocol 2 with P=0.9 (3.6 cm^3 - IQR: 6.7 vs. 3.5 cm^3 - IQR: 6.0, respectively). Lesion density values were similar in both protocols, P=0.47 (71.5 HU - IQR: 60 HU vs. 76 HU - IQR: 63 HU).
Conclusion: CT reconstruction algorithm did not affect the semi-automated quantification of size and density of liver metastasis.
Author Disclosures:
A.R. Seyal: Research/Grant Support; Educational Grant Support from Siemens Healthcare. **K. Parekh:** Research/Grant Support; Educational Grant Support from Siemens Healthcare.

B-0923 14:18

Automatic tube voltage selection and combined SAFIRE reconstruction: the application research in the enhanced abdominal scan

R. Zhang, B.J. Gao; *Zhengzhou/CN (zhangrui6886@126.com)*

Purpose: To investigate the value of automatic tube voltage selection (CARE kV) and combined with sinogram-affirmed iterative reconstruction (SAFIRE) technology in improving image quality and reducing radiation dose in the abdominal imaging.
Methods and Materials: Retrospective analysis,70 patients underwent contrast-enhanced abdominal CT and randomly divided into 2 groups. 35 patients were assigned to study group, using the tube voltage of CARE kV, reconstructed with FBP (protocol A) and SAFIRE (protocol B), respectively; 35 patients were assigned to control group, using the tube voltage of 120 kVp, reconstructed with FBP (protocol C). Assess the radiation dose (CTDIvol, DLP, ED), the mean image noise, contrast-to-noise ratio (CNR) and signal-to-noise ratio (SNR) relative to muscle for liver, pancreas, kidney, aorta and portal vein with each protocol. A five-point scale was used to evaluate the subjective of image quality. The statistical analysis method includes: paired-sample t test, independent-samples t test and Wilcoxon test.
Results: ED in the study group and control group is (3.90±0.37, 4.93±0.41) mSv, reduced by 20.89%. The subjective rating scores in protocol A/B/C in arterial and venous phase were (3.65±0.08, 3.57±0.08), (4.41±0.10, 4.41±0.10) and (3.79±0.10, 3.95±0.11) point ($P < 0.001$). The image noise of protocol A/B/C in dual-phase were (11.96±0.33, 12.79±0.39), (8.45±0.26, 9.14±0.36) and (10.38±0.26, 11.13±0.18) HU ($P < 0.001$). SNRs and CNRs in protocol B were the highest of three protocols ($P < 0.001$). No statistically significant differences between protocol A and C in SNRs and CNRs.
Conclusion: Use of CARE KV technology alone can reduce the radiation dose but increase image noise; the combination use of SAFIRE reconstruction technique can reduce dose and improve image quality.

B-0924 14:27

Generating normal reference values for examinations of the liver using acoustic radiation force impulse virtual touch tissue quantification (ARFI-VTTQ) elastography and comparison with acoustic radiation force impulse virtual touch imaging and quantification (ARFI-VTIQ) elastography: first results of a pilot study

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Purpose: Virtual touch tissue quantification (VTTQ) and virtual touch imaging and quantification of acoustic radiation force impulse (ARFI) permits quantitative measurement of tissue elasticity. Reliable use of these methods for assessing pathological changes in hepatic tissue requires establishment of normal reference ranges for findings returned by ARFI-VTTQ and ARFI-VTIQ in the healthy liver.
Methods and Materials: After excluding patients with known history of liver disorders, a total of 188 volunteers (57.4%, women; 42.6%, men; mean age, 31.1±13.0 years) were examined. All patients were examined in the right MCL cranially and caudally, and in the right and left liver lobes using the 6C1 (ARFI-VTTQ) and 9L4 (ARFI-VTIQ) transducers. ARFI-VTIQ measurements were examined in 15 and 25 mm and ARFI-VTTQ measurements in 5 cm depth.
Results: ARFI-VTTQ showed a mean value of 1.3±0.2 m/s (range=0.9-2.1). The difference in ARFI-VTTQ values between men and women was statistically significant ($p <.0001$). Significant correlation of ARFI-VTTQ values with age was observed (p=0.0.0281). ARFI-VTTQ values were not higher in female subjects using oral contraceptive steroids (p=0.8823).There was, however, a statistical significant correlation between ARFI-VTIQ and ARFI-VTTQ values. Additionally, ARFI-VTIQ values for measurements near with liver capsule were significantly higher than those for measurements of deeper measurement regions.
Conclusion: ARFI-VTTQ and ARFI-VTIQ values in healthy hepatic parenchyma can be influenced by many factors. Differences between the two transducers used in the present study are related to physical factors. The study could serve as the basis for further studies of measurements in pathologically altered hepatic parenchyma.

B-0925 14:36

Hypodense liver lesions in patients with steatosis hepatis: do we profit from the additional image information of dual-energy computed tomography?

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Purpose: To assess potential benefits of dual-energy CT (DECT) for imaging of hypodense liver lesions in patients with steatosis hepatis with regard to objective image quality (IQ).
Methods and Materials: 105 patients with steatosis hepatis underwent DECT (portal-venous phase) with reconstruction of 4 different datasets: pure iodine (PI), optimum contrast (OC), 80 kVp, and 120 kVp-equivalent (linear blended dataset: 30% 80 kVp, 70% 140 kVp; M0.3). Objective image quality was evaluated by determining image noise (IN) in liver parenchyma, hypodense liver lesion, muscle, lesion-to-liver signal-to-noise (SNR) and lesion-to-liver contrast-to-noise (CNR) ratios, and comparing these by one-way-ANOVA / Dunn's-Multiple comparison test. Intra- and inter-observer agreement (2 observers, each performing 2 independent ROI-measurements) was determined by Bland-Altman-Analysis. Average effective radiation dose (ERD) was determined.
Results: 21 patients with hypodense liver lesions were identified. IN for liver parenchyma, hypodense lesion, and muscle was lowest in PI (6.7/6.9/7.6 HU) followed by M0.3 (11.9/12.9/13.6 HU), and OC (16.7/13.5/16.3 HU), highest in 80 kVp (20.5/22.1/21.9 HU). SNR was highest in PI (1.3), followed by M0.3 (0.72), and 80 kVp (0.63), lowest in OC (0.55). CNR was highest in M0.3 (4.95), followed by OC (4.55), and 80 kVp (4.1), lowest in PI (3.63). Intra- and inter-observer agreement was high for all IQ parameters. ERD was 5.45mSv (3.48 - 10.16mSv).
Conclusion: Highest overall objective IQ for depicting hypodense liver lesions in patients with steatosis hepatis was found for 120 kVp-equivalent images. Therefore, DECT does not seem necessary for these patients despite additional image information offered by DECT, especially given the potentially increased radiation exposure compared with 'single-energy' CT at 120 kVp.

B-0926 14:45

Diagnostic performance of liver imaging in patients with suspected colorectal liver metastases: the superiority of MRI

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Purpose: To evaluate the diagnostic performance of preoperative state-of-the-art imaging of colorectal liver metastases (CRLM).
Methods and Materials: Forty-six consecutive patients scheduled for resection of suspected CRLM were evaluated prospectively over a 1.3-years period (2011 to 2013). None of the patients had undergone previous treatment for their CRLM. Dynamic 40-slice CT (unenhanced, arterial, portal-venous and delayed-phase), low-dose FDG-PET/CT and liver-MRI with T2-weighted single-shot, T1-weighted in- and opposed-phase, T2 weighted TSE-SPIR, diffusion-weighted and dynamic Gd-EOB-DTPA (Primovist®) enhanced sequences were used. Examinations were evaluated by two independent and blinded readers. The reference standard (RS) was histopathological confirmation (77/135 CRLM) or a clinical assessment based on follow-up examinations (58/135 CRLM).
Results: RS confirmed 412 lesions including 135 CRLM. On a per lesion basis, sensitivity was 70%, 90% and 63% for CT, MRI and FDG PET/CT, respectively. The corresponding specificity was 94%, 87% and 99%. RS confirmed CRLM in 42 patients and sensitivity on a per patient basis was 93%, 100% and 98% for CT, MRI and PET/CT. For CRLM of less than 10 mm in size sensitivity was 17%, 68% and 10% for CT, MRI and PET/CT, respectively. Specificity was 96%, 89% and 98%, respectively.
Conclusion: MRI had higher sensitivity especially for CRLM of less than 10 mm in size but specificity was comparable to CT and FDG-PET. Differentiation of hemangiomas and concurrent mucinous CRLM was challenging on MRI. In cases of remaining uncertainty CT and FDG-PET/CT can improve characterisation of liver lesion particular if above 10 mm in size.

B-0927 14:54

Normal values of liver and spleen stiffness measurements using shear wave elastography (SWE)

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Purpose: To determine the normal range of Liver Stiffness (LS) and Spleen Stiffness (SS) measured by Shear Wave Elastography (SWE) and the cutoff level between normal liver and CLD.
Methods and Materials: 89 patients underwent US and Color Doppler of the liver, the portal vein, the spleen and SWE of the liver and spleen. Normal group (n=48) was defined as men and women 21 to 50 years old with body mass index < 25 and without any clinical evidence of liver disease and normal laboratory and ultrasonographic findings. Comparative groups were non-cirrhotic chronic liver disease (NCCLD; n=16) and liver cirrhosis (LC; n=25) groups with various CLD, including viral hepatitis and alcoholic LD.
Results: In the normal group, mean value of LS was 4.9 ± 1.7 kPa (95% CI, 4.6-6.6 kPa) and mean SD was 1.7 ± 0.5 kPa (95% CI, 1.5-1.7 kPa). In the normal group the mean spleen stiffness (SS) was 10.4 ± 3.4 kPa (95% CI, 9.1-10.4 kPa). In the NCCLD group mean LS were 9.4 ± 4.4 kPa (95% CI, 7.8-9.9 kPa) and 18.7 ± 8.9 kPa (95% CI, 15.9-21.7 kPa) in the LC group. SD were 2.35 ± 1.49 kPa (95% CI, 1.96-2.74 kPa) in NCCLD and 7.37 ± 7.06 kPa (95% CI, 4.74-10.01 kPa) in LC.

Conclusion: The range of Liver Stiffness in the normal group was 4.6 to 6.6 kPa and for Spleen Stiffness was 9.1 to 10.4 kPa. The LS considered as a cut-off level differentiated from Chronic Liver Disease was 7.4 kPa.

B-0928 15:03

Potential dual energy volume scan implemented by 320-section area detector CT (320-deADCT) through lower-dose acquisition imaging protocol applied in liver tri-phase CT application: initial experience in Taiwan

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Purpose: The aim of the study was to decrease radiation dose utilised by 320-*de*ADCT scanner with DE imaging protocol for HCC follow-up cases without compromising image quality and volume accuracy.
Methods and Materials: 51 hepatocellular carcinoma (HCC) follow-up patients implemented by liver tri-phase examination were collected in this study. The first phase of 16 cm coverage liver exam was performed using conventional helical scan with 120 kVp, tube current modulation and denoising iterative reconstruction (IR) technology for non-contrast enhancement; whilst 16 cm lower-dose DE volume scans with 135 kVp/80 kVp switch, mA adjustment and IR technology were executed to catch arterial and venous phases. Both qualitative and quantitative analyses were done and liver volume accuracy was evaluated with liver phantom as well.
Results: With the 320-*de*ADCT scanner, we can intensify contrast resolution in the hypervascular HCC lesions. 110 kVp enhanced images were chosed for quality optimisation in comparison with that of 120 kVp images. The qualitative rating of 110 kVp images for arterial (venous) phases is 4.94; SNRs of 110 kVp and 120 kVp images for quantitative analysis are 8.2±0.6 (7.8±0.1), 15.0±2.5 (12.0±2.2), 30.7±4.0 (27.1±5.2), 12.2±1.1 (9.3±1.3), 7.6±2.7 (6.9±0.9), and -19.3±4.7 (-18.0±3.8) on liver parenchyma, liver lesion, aorta, spleen, muscle and subcutaneous fat, respectively. Patients received 1.6mSv mean dose with excellent volume accuracy ($p < 0.05$) acquired 34.7% radiation dose reduction compared to that in general helical scan (2.5mSv mean dose).
Conclusion: 320-*de*ADCT scanner with lower-dose DE acquisition protocol could generate excellent image quality without compromising diagnostic purposes.

B-0929 15:12

Performance of integrated adaptive iterative dose reduction 3D into automatic tube current modulation in radiation dose and image noise reduction compared with filtered-back projection for 80-kVp liver CT: anthropomorphic phantom and patient study

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Purpose: Evaluate the radiation dose and image quality of adaptive iterative dose reduction 3D (AIDR 3D) integrated into automatic tube current modulation (ATCM) compared with filtered-back projection (FBP).
Methods and Materials: Two part study consisting of anthropomorphic phantom validation and prospective patient evaluation using the same acquisition parameters. Sixty-three patients underwent 80-kVp non-contrast liver CT with FBP and AIDR 3D acquisitions using the same standard deviation of noise level. AIDR 3D images were reconstructed with 'strong' and 'standard' settings. The mean attenuation, image noise, signal-to-noise (SNR) of the left and right liver, aorta and psoas muscle were measured and compared. The effective diameter (ED) at level of T12 was measured. The size-specific dose estimate (SSDE) was calculated from console CTDIvol.
Results: Initial phantom study validated the radiation and image noise reduction potential of AIDR 3D reconstruction. In patients, there was no significant difference in mean attenuations between FBP and AIDR 3D reconstructions. The mean SSDE for AIDR 3D and FBP acquisitions was 13.3 and 25.2 mGy, respectively. In patients with ED < 29 cm, there was a 55.3% radiation dose reduction compared with FBP, whilst AIDR 3D 'strong' and 'standard' reconstructions showed a mean noise reduction of 28.5 and 16.2%, respectively. The SNR was significantly higher in AIDR 3D and independent of the patient's ED ($p < 0.01$).
Conclusion: Integration of AIDR 3D into ATCM allows for significant automatic reductions in radiation dose and image noise compared with FBP. AIDR 3D acquisitions allows for imaging of larger patient sizes with low-kilovoltage acquisitions.

B-0930 15:21

Comparison between CT perfusion and indocyanine green retention test: time to peak values can provide a non-invasive esteem of liver function

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Purpose: To evaluate the use of perfusion CT in the estimation of liver function, comparing the perfusional data with the indocyanine green retention test results and assessing their correlation with post-hepatectomy liver failure.
Methods and Materials: 31 patients with hepato-biliary malignancies, scheduled for liver resection, have been enrolled. A pre-operative perfusion CT and the indocyanine green retention test were performed in the same day and the results were compared using Pearson's correlation test. Perfusion parameters were also compared with CT-measured future remnant liver volume
Results: High correlation was found between the single arterial input time to peak values and the ICGR15 and ICG-PDR values (R= 0.789 and -0.790, respectively; $p < 0.0001$). The comparison between the time to peak values obtained by pCT with single portal input analysis and the ICGR15 and ICG-PDR values reported even higher correlation (R= 0.832 and - 0.823, respectively; $p < 0.0001$). In cirrhotic patients arterial TTP, ICGR15 and prothrombin Time are significantly higher compared with non-cirrhotic patients (p=0.048). Higher levels of arterial TTP, ICGR15 and PT are significantly related with signs of PHLF (p=0.004, 0.004 and 0.001, respectively). At multivariate analysis arterial TTP, ICGR15 and FRLV are significantly related with incidence of PHLF (HR 2.886, p value 0.024 and HR 0.034, p value 0.023, respectively).
Conclusion: pCT may be an effective method to estimate liver function. Time to peak values have shown high correlation with ICGR15 and ICG-PDR values. Further studies are needed to validate these results.

14:00 - 15:30 **Room C**

Neuro

SS 1811a
Novel CT techniques

Moderators:
C. Hoffmann; Tel Hashomer/IL
E. Pravatà; Lugano/CH

B-0931 14:00

Ultra-low-dose Sinogram affirmed iterative reconstruction in head CT: satisfactory for repeated surveillance exams in neurosurgical ICU

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Purpose: To assess the image quality of ultra-low-dose (ULDCT) head CT reconstructed with sinogram affirmed iterative reconstruction (SAFIRE) versus low-dose (LDCT) SAFIRE and standard-dose (SDCT) examinations reconstructed with filtered back projection (FBP), by evaluating examinations of the same patient, and to compare its effect on radiation dose in a neurosurgical intensive care unit (NSICU) population.
Methods and Materials: A retrospective analysis of 60 head CT acquired during 2012-2013 was performed. We compared ULDCT (n=28, avg CTDIvol =15.55 mGy), LDCT (n=12, 36.46 mGy) and SDCT (n=20, 48.38 mGy). SDCT exams were performed on a variety of clinical Siemens scanners using FBP reconstruction technique. All LDCT and ULDCT exams utilised a commercially available iterative reconstruction (IR) technique - SAFIRE at a setting of 3 on a Siemens AS+ 128 scanner. These studies were evaluated for image quality, noise and radiation dose.
Results: With ULDCT-SAFIRE, a 68% reduction of the CTDIvol of head CT exams was seen compared to routine SDCT-FBP (79% below ACR guidelines), while maintaining comparable quality and similar noise levels. LDCT-SAFIRE offers a higher image quality compared to SDCT-FBP with no differences in noise. When compared to LDCT, ULDCT had significantly higher image noise and lower, yet still satisfactory, qualitative measures of image quality.
Conclusion: ULDCT-SAFIRE allows a substantially lower dose, while maintaining quality sufficient for repeated surveillance head studies of NSICU patients. ULDCT-SAFIRE studies were satisfactory, comparing favourably to SDCT-FBP. Implementation of SAFIRE for CT scans performed on NSICU patients leads to a 68% reduction of radiation while maintaining image quality.

B-0932 14:09

Knowledge-based iterative reconstruction technique allows for extreme low dose for cerebral and carotid CT angiography studies

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Purpose: To evaluate the potential of substantially reduced dose for cerebral and carotid CT angiography studies by using a new knowledge-based iterative reconstruction technique (IMR, Philips Healthcare) without any adverse impact on accuracy.
Methods and Materials: Cerebral and carotid CT angiography scans were acquired using a 256-slice MSCT (Brilliance iCT, Philips Healthcare) on 60 patients with normal body mass index (BMI, 20-25 kg/m^2) who were randomly assigned into 2 groups (group A and group B). The scan protocols for different groups were drawn up as follows (table in uploaded image).The mean image noise and CNR of different groups were measured on CT images and compared using the paired-t test. In addition, image quality evaluation was performed by two radiologists who were blinded to scan protocol, using a five-point confidence scale (1 [poor] to 5 [excellent]).The results of the two groups were compared with the Mann-Whitney U-test.
Results: There was no difference in mean image noise, CNR and image quality between group A and B ($p > 0.05$). By using knowledge-based IMR reconstruction technique, the low dose protocol for group B was feasible with no significant loss in image quality or any negative effect on diagnosis confidence. Compared to group A, group B reduced radiation dose by 71% and the iodine volume by 27%.
Conclusion: Knowledge-based iterative reconstruction technique allows for both low radiation and contrast medium doses for cerebral and carotid CT angiography.

B-0933 14:18

Brain CT perfusion: effective dose reduction by using hybrid iterative reconstruction and different low-dose protocols

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Purpose: To evaluate the effect of hybrid iterative reconstruction on qualitative and quantitative parameters of low-dose 256-MDCT perfusion imaging.
Methods and Materials: 30 consecutive patients were enrolled in the study. CT perfusion in first group (n=10) was examined under 80 kv 150 mAs, second group (n=10) - 80 kv 100 mAs, and 80 kv 50 mAs in third group. CT images in first group were reconstructed only with the filtered back projection (FBP). CT data in second and third groups were reconstructed both with FBP and three levels of hybrid iterative reconstruction algorithms (iDose1, 3, 5). We compared quantitative and qualitative parameters of images among the three groups. Quantitative blood flow perfusion parameters were compared between four reconstructions in second and in third groups.
Results: Effective dose was 4.7±0.07mSv in first group, 3.08±0.07mSv in second group and 1.5±0.07mSv in third group; differences were significant ($p < 0.05$). Image noise using FBP was 3.1±0.49 in first group, 4.64±0.6 in second group and 7.1±0.88 ($p < 0.05$) in third group. Overall CT perfusion maps quality decreased using second and third low-dose protocols in combination with FBP. The quality of images increased significantly ($p < 0.05$) when applying hybrid iterative reconstruction. In all studies there was no significant difference in selected quantitative parameters between acquired data after FBP and iDose1, 3, 5 reconstructions ($p > 0.05$).
Conclusion: Low-dose CT perfusion using hybrid iterative reconstruction may provide sufficient image quality and allows for significant reduction of radiation dose to the patient.

B-0934 14:27

Iterative reconstruction: Improvement of image quality for dynamic CT brain perfusion imaging

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Purpose: Impact quantification of iterative reconstruction (iDose) on image noise, SNR and CNR of brain matter and investigation of radiation dose savings by evaluation of stability of rCBV in iMTT.
Methods and Materials: CTP was obtained in 27 patients using a 256- slice CT. Images were reconstructed with filtered backprojection (FBP) and five different levels of IR (LD 1- LD 5). Noise, CNR (cortex vs. white matter), SNR and rCBV in iMTT were determined.
Results: Noise was reduced from 5.7 ± 0.1 (FBP) to 3.8 ± 0.2 (LD 5) for grey cortex and from 6.4 ± 0.0 (FBP) to 4.0 ± 0.1 (LD 5) for white matter. SNR improved from 6.7 ± 3.3 (FBP) to 10.3 ± 0.6 (LD 5) for grey cortex as well as for white matter from 4.0 ± 12.3 (FBP) to 6.5 ± 3.3 (LD 5). CNR increased from 2.2 ± 0.1 (FBP) to 3.5 ± 0.1 (LD 5) for grey matter vs. white matter. The parameter rCBV in iMTT were varying only slightly with a mean rCBV 4.1 ± 0.1 and a mean relation rCBV/nCBV 0.27 ± 0.02 for all IR- levels.
Conclusion: Iterative recontruction can improve SNR and CNR by noise reduction of about 33%. Iterative reconstruction may save radiation dose in brain perfusion imaging. Moreover, the use of different IR-levels of iDose (LD 1-5) does not effect the CT brain perfusion parameters rCBV and MTT as two distinct PCT parameters which differ the penumbra and the infarct core in the summary maps.

B-0935 14:36

Head CT: adaptive statistical iterative reconstruction protocol- the same image quality and lower radiation dose comparing to filtered back projection (FBP) protocol

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Purpose: To compare dose radiation and image quality (SNR, CNR) of head CT examinations of the same patients obtained with different protocols: Adaptive Statistical Iterative Reconstruction (ASIR) and Filtered Back Projection (FBP) using two 64 MDCT scanners.
Methods and Materials: Head CT studies of 55 consecutive patients (29 females/26 males, mean age 60 yrs) were examined twice for medical indications (trauma), using two different 64 MDCT scanners. Initial examination was performed using FBP reconstruction. In the follow-up examination of the same patient ASIR protocol was used. Scan parameters were held constant regarding tube voltage (120 kV), sequential scanning (2.5 mm/5 mm). ASIR was performed at 40% level. CT dose index volume (CTDvol) were recorded and compared. Two blind radiologists reviewed all CT examinations assessing image noise (SNR), contrast (CNR) and diagnostic acceptability.
Results: Comparison of head CT using FBP and ASIR scanners showed very significant differences ($p < 0.001$) in average effective dose (1.72±0.07 and 1.38±0.12 [mSv], respectively). There was no significant difference in image quality between two types of reconstructions. SNR for white matter was 7.3 for FBP and 8.7 for ASIR (P=0.1) and for grey matter 9.7 vs. 11.6 (p=0.6) respectively. Contrast between white and grey matter was 0.8 and 1.2 (p=0.1), respectively. The overall diagnostic score was 2.6 vs. 2.7 (in 3-point scale).
Conclusion: Head CT using ASIR protocol effectively reduces exposure dosage by about 25% without sacrifying image quality. Contrast between white and grey matter is on the equal level in FBP and ASIR group.

B-0936 14:45

A reduced contrast volume acquisition regimen based on cardiovascular dynamics reduces radiation dose during carotid MDCT angiography

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Purpose: To investigate the dose length product (DLP) during carotid computed tomography angiography (CCTA) using a patient-specific contrast formula.
Methods and Materials: CCTA was performed in 202 patients with stroke like symptoms using a 64-channel computed tomography scanner and a dual-barrel contrast injector. Patients were subjected in equal numbers to one of two acquisition/contrast regimens. Patient age and gender were equally distributed across both groups. Regimen A, the department's standard protocol, consisted of a caudocranial scan direction with 100 mL of contrast, intravenously injected at a flow rate of 4.5 mL/s; Regimen B, involved a craniocaudal scan direction and a novel contrast formula based on patient cardiovascular dynamics. Each scan acquisition comprised of 120 kVp, 300 mA with modulation, temporal resolution 0.4 sec and pitch 0.981:1. The DLP was measured between each regimen and data generated were compared using Mann-Whitney U non-parametric statistics.
Results: The mean contrast volume was significantly lower in regimen B (53 ± 10 mL) compared to A (100 ± 1 mL) ($p < 0.001$). There was no significant difference in mean scan time in regimen B (4.22 ± 1.2 sec) compared to A (4.01 ± 1.3 sec) with equal distribution in scan range between each regimen (A: 29.2 + 3.01 cm and B: 28.9 + 4.03 cm). Mean DLP demonstrated significant reduction in regimen B (3.09+0.22 mSv) compared to A (4.74+0.22 mSv)($p = 0.02$).
Conclusion: Significant reduction in radiation dose during CCTA can be achieved using low contrast volume based on patient specific contrast formula.

B-0937 14:54

Patient-specific contrast protocol based on cardiovascular dynamics reduces radiation dose during intra-cranial MDCT angiography

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Purpose: To investigate the dose length product (DLP) during intra-cranial computed tomography angiography (ICTA) using a patient-specific contrast formula.
Methods and Materials: ICTA was performed in 80 patients with stroke-like symptoms using a 64-channel computed tomography scanner. Patients were subjected in equal numbers to one of two contrast regimens. Regimen A, the department's standard protocol, consisted of a craniocaudal scan direction with

80 mL of contrast, intravenously injected at a flow rate of 4.5 mL/s; Regimen B, involved a novel contrast formula based on patient cardiovascular dynamics. Each scan acquisition comprised of 120 kVp, 300 mA with modulation, temporal resolution 0.4 seconds and pitch 0.981:1. The DLP was measured between each regimen and data generated were compared using Mann-Whitney U non-parametric statistics.
Results: Mean vessel attenuation in the segments of the circle of Willis was up to 39% ($p < 0.02$) greater in regimen B compared to A. In the venous system, attenuation was significantly lower in regimen B compared to A with a maximum reduction of up to 86% ($p < 0.001$). The mean contrast volume was significantly lower in regimen B (53±10 mL) compared to A (80±1 mL)($p < 0.001$). There was no significant difference in mean scan time in regimen B (4.22±1.2 sec) compared to A (4.01±1.3 sec) with equal distribution in scan range between each regimen (A: 29.2±3.01 cm and B: 28.9±4.03 cm). Mean DLP demonstrated significant reduction in regimen B (3.99±0.22 mSv) compared to A (4.74±0.22 mSv) ($p = 0.02$).
Conclusion: Significant reduction in radiation dose during ICTA can be achieved using low-contrast volume based on patient-specific contrast formula.

B-0938 15:03

Both contrast medium dose and injection rate reduction in carotid-cerebral angiography with 256-slice MSCT: feasibility study of a new injection protocol for improving patient safety
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Purpose: To evaluate the potential of substantially reduce dose for cerebral and carotid CT angiography studies by using a new low-dose protocol without any adverse impact on accuracy.
Methods and Materials: CT carotid-cerebral angiography scans were acquired using a 256-slice MSCT (Brilliance iCT, Philips Healthcare) for 60 atherosclerosis suspected patients with normal BMI (20-25 kg/m2) who were randomly assigned into 2 groups (30 patients each). Patients in group A received 60 ml iodine contrast medium (370 mgI/ml) with an injection rate of 4.5 ml/s by using bolus tracking, while patients of group B received 30 ml contrast medium (370 mgI/ml) with an injection rate of 3.0 ml/s also by using bolus tracking. The scan protocol for both groups was 120 kV, 250 mAs and all images were reconstructed using an IR technique (iDose4, Philips Healthcare). Mean carotid-cerebral arterial CT numbers and CNRs of two groups were measured. In addition, each group was blindly evaluated by two radiologists for image quality (rated on a 5-points confidence scale (1 [poor] to 5 [excellent]).Statistical analysis was performed using paired-t test.
Results: Compared to group A, group B reduced the iodine delivery rate by 33.5% from 1.67 gI/s to 1.11 gI/s and the total iodine volume by 50% from 22.2 gI to 11.1 gI. There was no significant difference in mean carotid-cerebral arterial CT numbers, CNRs and image quality between two groups ($p > 0.05$)).
Conclusion: By using 256-slice MSCT and an iterative reconstruction technique, a low-iodine contrast protocol for carotid-cerebral CTA can reduce both contrast medium dose and injection rate without any negative impact on accuracy.

B-0939 15:12

Co-registration of transcranial ultrasound and CT-angiography: a methodological study in cerebrovascular disease
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Purpose: Multimodal imaging is used increasingly in acute cerebrovascular disease. A previously obtained CT dataset can guide a real time transcranial duplex (TCD) dataset if a mutual focus point determines interpretation of movement directions represented by scrolling on CT and corresponding angulation of the transducer, i.e. identifying the same middle cerebral artery branch. Aim was to evaluate a fast bedside method using a CT dataset as guide for serial monitoring of acute stroke patients with transcranial duplex.
Methods and Materials: The temporal window centre was chosen as focus point on TDC and subsequently transcribed to the CT modality. Local bone density and thickness vary and the possibility of repeated identification the identical focus point equals the degree of measurement variation. Bilateral measurements were obtained in 10 patients 3 times each on 3 different non-contrast cerebral CTs (one observer). A phantom applicable to both computed tomography and ultrasound was used to test for software and intermodality induced size distortion. The phantom underwent CT-scan equipped with a casement fixating an ultrasound transducer in one location, which was used during the subsequent ultrasound performed during real-time fusion on a Logic E9 GE ultrasound apparatus. Using distance measurements from the surface to 5 predefined fix points; variation was considered insignificant below 3 mm.
Results: Measurement between modalities did not reach or exceed the defined level of significance. Repeated measurements of focus point showed no significant variation.
Conclusion: We present a novel technique for monitoring patients in the unstable phase of acute stroke.

B-0940 15:21

One-step stroke imaging: does an interleaved acquisition of cerebral CT perfusion and CTA of the carotids affect CTP values?
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Purpose: One-step stroke imaging is a CT perfusion (CTP) scan in which one volumetric acquisition is replaced to acquire a carotid CTA using toggling table technique and a single dose of contrast agent. The purpose of this study is to determine if missing one acquisition of the CTP influences the CTP values.
Methods and Materials: Ten patients with suspicion of ischemic stroke were scanned with a clinical CTP head protocol (14 scans every 2s, 5 scans every 5s) with a total duration of 55s using a 320-row CT scanner. The one-step stroke protocol is simulated from the original clinical protocol by deleting one acquisition. For every patient, the timepoint of the bolus arrival time (BAT) and the arterial peak (AP) in the middle cerebral artery was determined. One acquisition was deleted starting from the BAT up to the fifth time point after AP. Corresponding perfusion maps were calculated with bSVD using PMA-ASIST. Regions of interests (ROIs) were annotated in normal-appearing grey and white matter. The percentage errors were calculated per timepoint and patient.
Results: The absolute mean of the percentage errors across all patients for each timepoint in grey matter compared to the original CBF, CBV and MTT is 3.40%(range 0.10-9.53%), 3.22%(0.00-9.98%) and 3.08%(0.00-13.79%), respectively. Percentage errors> 8.50% occurred for some patients if an acquisition was deleted at BAT, 2s-4s after BAT, AP or after the AP. Similar results were found in WM.
Conclusion: A one-step stroke protocol is feasible with only minor effects on the CTP maps if CTA is acquired 2-4s after BAT and before the AP.
Author Disclosures:
R. Manniesing: Grant Recipient; Toshiba Medical Systems Corporation, Japan. **M. Prokop:** Grant Recipient; Toshiba Medical Systems Corporation, Japan, Philips Medical Systems. Speaker; Bracco, Toshiba Medical Systems Corporation, Bayer-Schering, CME Science, Philips Medical Systems.

14:00 - 15:30 **Room D**

Chest

SS 1804

Lung structure and function

Moderators:
P.A. Grenier; Paris/FR
N. Sverzellati; Parma/IT

B-0941 14:00

Size and collapsibility of emphysema holes on CT of COPD: evaluation with a new method
S.Y. Oh, J.B. Seo, S. Lee, N. Kim, M. Lee; *Seoul/KR (ojangsa@gmail.com)*

Purpose: Although the extent of LAA at CT of COPD is known to correlate with loss of lung function, the size and collapsibility of emphysema holes were rarely investigated. The purpose of this study is to assess the size and collapsibility of emphysema clusters with a new method and to correlate it with pulmonary functional test (PFT).
Methods and Materials: Volumetric, inspiration and expiratory CT scans in 60 COPD patients were selected. After extracting the area of LAA using the threshold of -950 HU, a new method of size classification of LAA, which is repeated application of multiple low-pass filter with various size of Gaussian kernel, was used. Emphysema clusters were divided into four groups; E1< 1.5 mm, 1.5 mm≤E2< 7 mm, 7 mm≤E3< 15 mm, 15 mm≤E4. The difference in distribution of each group between inspiration and expiration CT was assessed. The results were compared with PFT with Pearson correlation.
Results: The mean extents of LAA, E1, E2, E3, and E4 were 27.2%, 3.9%, 6.8%, 12.9%, 3.5% on inspiration CT, 16.5%, 1.66%, 7.8%, 4.2%, 2.9% on expiratory CT, respectively. Among the four clusters, E3 showed larger decline on expiratory CT than other clusters. Both E2 and E3 were significantly correlated with FEV1 (r=-0.449 and -0.423, respectively).
Conclusion: Emphysema clusters of sublobular size were most collapsible. Emphysema of acinar and sublobular size contribute most to the FEV1 decline. This study shows that in addition to the extent of LAA, the size of emphysema clusters at CT of COPD should be also considered in relation to the loss of lung function.

B-0942 14:09

CT-quantified airway wall thickness and emphysema: association with lung function decline and development of airflow limitation

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Purpose: Structural pulmonary changes like airway wall thickness and emphysema contribute to airflow limitation. It is unknown whether emphysema and airway wall thickness quantified on computed tomography (CT) independently associate with lung function decline and development of airflow limitation.

Methods and Materials: Male former and current smokers without and with airflow limitation participating in a lung cancer screening study were included and underwent baseline and follow-up spirometry and chest CT scanning. Airway wall thickness and emphysema were quantified automatically and expressed as the square root of wall area for a theoretical airway with 10 mm lumen perimeter (Pi10) and the 15th percentile method (Perc15), respectively.

Results: 2,021 subjects were included. Median (interquartile range) of follow-up was 3.0 (2.9-3.1) years. At univariate analyses Pi10 and Perc15 correlated with baseline FEV1, r=-0.49 and 0.11, respectively ($p < 0.001$). Multiple linear regression analysis showed that Pi10 and Perc15 were independently associated with a lower FEV1 after follow-up ($p < 0.05$). For each standard deviation increase in Pi10 and standard deviation decrease in Perc15, FEV1 decreased with additional 20 mL and 30.2 mL, respectively. The adjusted odds ratio's for developing airflow limitation were 1.26 and 2.44, respectively.

Conclusion: A greater degree of airway wall thickness and emphysema on CT independently associate with a lower FEV1 and with development of airflow limitation after three-year of follow-up.

B-0943 14:18

Comparative assessment of T1 imaging, oxygen-enhanced MRI and first-pass perfusion MRI in chronic obstructive pulmonary disease at 1.5 Tesla

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Purpose: COPD phenotype and severity are insufficiently assessed by lung function testing alone. Therefore, alternative endpoints for interventional trials are pivotal. Lung T1 is known to depend on lung tissue and blood volume. It was the aim of this study to validate MRI-based T1 mapping and oxygen-enhanced MRI (OE-MRI) against first-pass perfusion MRI in COPD patients applying a user-friendly standardised assessment method.

Methods and Materials: 20 COPD patients (GOLD I-IV) underwent MRI, comprising of a coronal 2-dimensional inversion recovery snapshot flash sequence (8 slices/lung) at room-air and after supplementing pure oxygen, as well as first-pass contrast-enhanced perfusion imaging with high-temporal resolution (1.5s/lung) at roomair. The spatial extent of T1 shortening at roomair (ΔT1RA), reduction of oxygen-induced T1 shortening (ΔT1O2) and perfusion deficits of the upper, middle and lower zone of both lungs was reported by 2 chest radiologists in consensus, using a semi-quantitative 3-point scale for each item.

Results: In a zone-based approach ΔT1RA correlated positively with the extent of perfusion deficits (r=0.81; $p < 0.001$). ΔT1O2 also correlated positively with perfusion deficits (r=0.80; $p < 0.001$) and ΔT1RA (r=0.80; $p < 0.001$). Interestingly, in mild COPD ΔT1O2 was normal in 16/39 lung zones with perfusion deficits. In a per-patient approach perfusion deficits (r=0.52; $p < 0.05$), ΔT1RA (r=0.45; $p < 0.05$), and ΔT1O2 (r=0.52; $p < 0.05$) positively correlated with GOLD stage.

Conclusion: T1 mapping and OE-MRI demonstrated a good agreement with perfusion MRI and GOLD stage and provide complementary information about pathologic changes in COPD. In particular, OE-MRI contributes to the differentiation of hypoxic vasoconstriction and genuine perfusion impairment.

B-0944 14:27

Anatomical detail of single breath-hold, high resolution ultra-fast 3D balanced SSFP MRI of the chest in comparison to low-dose CT

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Purpose: To evaluate anatomical detail and image quality of a novel three-dimensional balanced steady state free precession (bSSFP) MRI sequence in comparison to low-dose CT.

Methods and Materials: In this IRB approved study 16 male patients (mean age 64 yrs). underwent same day chest imaging on a 1.5 T MRI (Avanto, Siemens Healthcare) and a 64-slice MDCT scanner (Definition Flash, Siemens Healthcare). MR acquisition was performed in a single breathhold (< 25sec) with 1.8 mm isotropic spatial resolution. Depiction of detail by ultra-fast bSSFP was evaluated by two experienced readers independently who assessed the number of branching points for 6 pre-defined pulmonary arteries. The distance between the most peripheral visible segments to the pleural surface was measured for each vessel and at 6 locations on 50 mm coronal maximum intensity projections (MIP). Image quality and sharpness was rated on a 5-point scale (5=best score). Similar measurements on CT data served as reference standard.

Results: Ultra-fast bSSFP identified 72.0% of branching points detected by CT (1077/1496). The mean distance, distal segments to pleura, on thin slices was 13.3 ± 4.3 mm versus 9.0 ± 3.3 mm (ultra-fast bSSFP versus CT; $p < 0.001$ t-test) and 8.9 ± 4.1 mm versus 4.8 ± 2.7 mm respectively on MIP reconstructions ($p < 0.001$ t-test). Mean image quality and sharpness were each rated as 4 (range 3-5).

Conclusion: Ultra-fast SSFP of the chest offers high resolution imaging in a single breath-hold with adequate image quality and sharpness allowing for visualisation of anatomical details comprising peripheral pulmonary vessels less than 15 mm to the pleural surface.

B-0945 14:36

Regional obstruction in cystic fibrosis: correlation of electric impedance tomography (EIT) and high-resolution-CT (HRCT) findings

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Purpose: Electric impedance tomography (EIT) provides both global and regional information on airway obstruction in patients with cystic fibrosis (CF). We correlated obstruction in CF patients as measured by EIT with high-resolution-computed-tomography (HRCT) findings based on the Brody-scoring system.

Methods and Materials: HRCT images (120 KVp, 35 mA, 64x0.5 mm, reformatting slice thickness, 1.0-1.5 mm and 3 mm, Brilliance CT64, Philips-Medical-Systems, Hamburg, Germany) of 5 selected CF patients (2 male, 3 female; age 38±11 years; height 165±8 cm; weight 56±8 kg; mean±SD) covering EIT-electrode positions±5 cm were evaluated by means of a weighted Brody-score, which considers bronchiectasis, mucous plugging, peribronchial thickening, parenchymal opacity and hyperinflation. Two-dimensional EIT measurements were performed at the level of the fifth intercostal space (EIT Evaluation KIT 2, Dräger Medical, Lübeck, Germany) on the same patients within 2 months of HRCT, during standard pulmonary function tests as recommended by the American-Thoracic-Society and European-Respiratory-Society guidelines. Ratios of maximum-expiratory-flow at 25% and 75% of vital capacity (MEF_{25}/MEF_{75}) were calculated for different lung regions in EIT images. After normality testing (Lilliefors test), linear regression (significance level, $p < 0.05$) was performed to assess the correlation between MEF_{25}/MEF_{75} values and weighted Brody-scores.

Results: Regional airway obstruction identified in MEF_{25}/MEF_{75} maps matched HRCT findings. Median values of MEF_{25}/MEF_{75} and weighted Brody-Score were highly correlated ($r^2=0.83$, $P < 0.05$).

Conclusion: In CF patients, severity of regional airway obstruction, as measured by means of EIT, correlates with severity of morphologic lung lesions, as measured in HRCT images by means of weighted Brody scores.

B-0946 14:45

Krypton ventilation imaging with dual-energy CT: correlation with pulmonary function tests in patients with chronic obstructive pulmonary disease (COPD)

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Purpose: To correlate krypton ventilation CT with pulmonary function tests (PFT) in COPD patients.

Methods and Materials: 31 patients underwent dual-source, dual-energy chest CT after inhalation of a mixture of 80% krypton and 20% oxygen, with reconstruction of morphologic and krypton-ventilation images with calculation of: (a) the total lung volume enhanced by krypton; and (b) the mean density of voxels with krypton. All patients were assessed with routine PFTs, including measurements of bronchial obstruction (FEV1; FVC; FEV1/FVC ratio), lung distension (RV; FRC; TLC), and destruction (DLco).

Results: Correlations were found between: (a) pulmonary volume enhanced by krypton (6161±1385 mL) and indexes of lung distension (TLC: r=0.78, $p < 0.0001$; FRC: r=0.57, $p < 0.01$); and (b) mean density of krypton (7.5±2.3 HU) and indexes of bronchial obstruction (FEV1: r=0.71, $p < 0.0001$; FVC: r=0.66, $p < 0.0001$; FEV1/FVC: r=0.54, $p < 0.01$) and lung destruction (DLco: r=0.62, $p < 0.01$). The difference in TLC, measured by body plethysmography versus the helium dilution method, inversely correlated with the mean density of krypton on ventilation maps (r=-0.55, p=0.0029). The mean density of krypton within voxels on the krypton-ventilation maps decreased from GOLD stage 1 to GOLD stage 4 (GOLD 1: 9.4±1.8 HU, GOLD 2: 8.1±0.5, GOLD 3: 7.6±2.4, GOLD 4: 5.8±1.6) and was significantly different between GOLD stages 1 and 2 (n=11) vs. GOLD stages 3 and 4 (n=17) (8.2±2.3 HU vs. 6.3±1.7 HU; p=0.016).

Conclusion: Krypton ventilation imaging on dual-energy CT correlates with functional parameters of bronchial obstruction, lung distention, and destruction, and provides significantly different results according to the GOLD stages.

B-0947 14:54

Value of density mapping in computed tomography for detection of bronchiolitis obliterans syndrome (BOS)

S. Dettmer, O. Solyanik, T. Kaireit, C. de Wall, F. Wacker, H.-o. Shin;
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Purpose: To prospectively evaluate the diagnostic value of density mapping for detection of bronchiolitis obliterans syndrome (BOS) following lung transplantation.
Methods and Materials: 386 CT examinations were performed in lung transplant patients in inspiration/expiration (64 row MDCT, 120 kVp, rotation time 0.8s, pitch 0.984, collimation 1.25 mm, reconstruction increment 1 mm). 44/342 examinations were performed in patients with/without BOS. Following automatic lung segmentation and non-rigid registration of inspiration to expiration, a point-to-point mapping of the HU values in inspiration and expiration was performed. A scatter plot was used to depict the frequency distribution of the point-to-point mapping (density mapping). This was characterised by the following location scales: the x value and y value of the median, the distances of the median to the origin/bisecting line and the first principal component (PCA).
Results: Scatter plots of HU values of the registered inspiration and expiration showed significant differences in patients with/without BOS. A shift to lower density values and a convergence to the bisecting line could be observed in patients with developing BOS. Evaluated measures of the frequency distribution in the density mappings were significantly different in patients with/without BOS for the y value of the median ($p < 0.001$, mean: -768 HU/-712 HU), the distance of the median to the origin ($p < 0.001$), the distance of the median to the bisecting line ($p < 0.001$) and PCA ($p=0.030$). The x value of the median ($p=0.859$) was not significant.
Conclusion: Density mappings were significantly different in patients with/without BOS and might be used as an imaging biomarker for the detection of BOS.

B-0948 15:03

Voxel-to-voxel analysis of inspiration-expiration CT datasets for detection of pathologic air trapping in lung transplant patients: comparison to the threshold-based method in expiration

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[1]*Moscow/RU*, [2]*Hanover/DE*

Purpose: To determine whether voxel-to-voxel analysis of inspiration-expiration CT datasets is more precise in detection of pathologic air trapping (pAT) in lung transplantat patients than the threshold-based method in expiration.
Methods and Materials: 144 lung transplant recipients underwent paired inspiratory-expiratory CT and PFTs six months after lung transplantation. Two methods based on voxel-to-voxel mapping of inspiration-expiration CT datasets (density mapping (DM) and parametric response map (PRM)) were compared to the threshold-based method in expiration (EXP). Attenuation ranges for EXP and DM were optimised by systematic variation and correlation with the ratio of residual volume to total lung capacity (RV/TLC) by Spearman rank correlation tests. For PRM published data was used. Correlations of CT methods with RV/TLC were evaluated by Spearman rank correlation test. AT was considered pathologic if RV/TLC was beyond the 95th percentile of the predicted values. The detection of pAT was assessed by comparing the areas under the receiver operating characteristic curves (AUC) of quantitative CT measures.
Results: According to RV/TLC pAT was present in 34 patients. DM and PRM correlated significantly better with RV/TLC than Exp $_{-790\ to\ -950\ HU}$ (DM r =0.66, PRM r=0.65 EXP r=0.52; $p < 0.01$). AUC of PRM and DM were significantly larger than by EXP (PRM: AUC 0.79, 95 % CI 0.704-0.876; DM: 0.78, 95% CI 0.691-0.865; Exp $_{-790\ to\ -950\ HU}$: 0.708, 95% CI 0.608-0.808).
Conclusion: DM and PRM showed better correlation with RV/TLC than the threshold-based method and were more precise in detection of pAT in lung transplantat patients.

B-0949 15:12

Early cystic fibrosis lung disease: monitoring changes in structure and perfusion and response to therapy with MRI

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Purpose: Recent studies demonstrating early structural lung damage in infants and preschool children with cystic fibrosis (CF) suggest that non-invasive monitoring will be important to identify patients who may benefit from early therapeutic intervention. For older CF patients, previous studies demonstrated that magnetic resonance imaging (MRI) detects structural and functional abnormalities in the lungs without radiation exposure. Therefore, our aim was to evaluate the potential of MRI to detect abnormal lung structure and perfusion in infants and young children with CF, and to monitor response to therapy for pulmonary exacerbation.
Methods and Materials: MRI studies were performed in 50 children with CF (age 3.1±2.1years, range 0-6years) in stable clinical condition (n=40) or pulmonary exacerbation before and after antibiotic treatment (n=10), and in 14 non-CF controls (age 2.1±1.8years). T1-weighted sequences before and after intravenous contrast, T2-weighted sequences and first-pass perfusion imaging were acquired, and assessed using a dedicated morpho-functional score.
Results: MRI demonstrated bronchial wall-thickening/bronchiectasis, mucus plugging and perfusion deficits from the first year of life in most stable CF patients (global score 10.0±4.0), but not in non-CF controls (score 0.0±0.0; $P < 0.001$). In patients with exacerbations, the global score was significantly increased to 18.0±2.0 ($P < 0.001$), and was restored to 12.0±3.0 ($P < 0.05$) after antibiotic therapy.
Conclusion: MRI detected abnormalities in lung structure and perfusion, and response to therapy for exacerbations in infants and preschool children with CF. These results support the development of MRI for non-invasive monitoring and as an endpoint in interventional trials for early CF lung disease.

B-0950 15:21

Is bronchial imaging affected by temporal resolution? Comparative evaluation at 140 and 75 ms in 90 patients

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Purpose: To evaluate the influence of temporal resolution (TR) on cardiac motion artifacts at the level of bronchial walls.
Methods and Materials: 90 patients (mean age: 50.2 yr, mean heart rate: 81.2 bpm) underwent a noncontrast CT examination with dual-source, single-energy (collimation: 32x2x0.6 mm; rotation time: 0.28 s). Two series of images were reconstructed using data from both tubes on a prototype workstation with a TR of 75 ms (i.e., optimised TR) (Group 1) and 140 ms (i.e., standard TR) (Group 2). Two radiologists independently analysed the presence and severity of cardiogenic artifacts at the level of 8 target bronchi (total number of bronchi examined: n=720).
Results: Cardiogenic artifacts were significantly less frequent and less severe in Group 1 than in Group 2 ($p < 0.0001$) with the highest scores of discordant ratings for bronchi in close contact with cardiac cavities: RB5 (61/90; 68%); LB5 (66/90; 73%); LB7 (63/90; 70%) ($p < 0.0001$). In Group 1, 78% (560/720) of bronchi showed no cardiac motion artifacts whereas 22% of bronchi (160/720) showed artifacts, rated as mild (152/160; 95%), moderate (7/160; 4%) and marked (1/160; 1%). In Group 2, 30% of bronchi (217/720) showed no cardiac motion artifacts whereas 70% of bronchi (503/720) showed artifacts, rated as mild (410/503; 82%), moderate (82/503; 16%) and severe (11/503; 2%). Intraobserver agreement for cardiac motion assessment was excellent (reader 1: kappa=0.85 [95CI: 0.73-0.96]; reader 2: kappa=0.88 [95CI: 0.76-0.99]); the interobserver agreement was good (kappa=0.61 [95IC: 0.43-0.80]).
Conclusion: At 75 ms, most bronchi can be depicted without cardiogenic artifacts.

14:00 - 15:30 **Board Room B**

Paediatric

SS 1812

Radiation reduction in paediatric imaging

Moderators:
R.A.J. Nievelstein; Utrecht/NL
S. Stafrace; Aberdeen/UK

B-0951 14:00

γ-H2 AX foci as effect biomarker for CT radiation exposure in paediatric patients: an individualised approach to estimate radiation risks

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Purpose: To evaluate biological effects and estimate cancer risks from paediatric CT, the γ-H2 AX foci assay was used as biomarker for radiation-induced double strand breaks in combination with patient-specific Monte Carlo dose simulation.
Methods and Materials: 51 paediatric patients (mean age, 4.5 years) were included. Patients underwent CT abdomen (10) or CT chest (41) in five Belgian radiology departments using state-of-the-art CT instrumentation and protocols. Blood samples were taken before and after the CT procedure and γ-H2 AX foci

were determined in peripheral blood T-lymphocytes. Patient-specific organ and tissue doses were calculated using ImpactMC 1.3.1 Monte Carlo software. Blood doses were calculated as a weighted sum of doses to lungs, heart, liver and remainder. Patient individualised estimations of lifetime attributable risks (LAR) for cancer mortality were determined according to the BEIR VII risk models.
Results: An average increase of 0.173 foci/cell was observed, despite the low CT doses (mean DLP chest 35.2 mGycm). Differences in observed γ-H2 AX foci scores reflected the differences in dose levels between radiology centers. Plotting the induced γ-H2 AX foci data versus the calculated blood doses, indicated a low-dose hypersensitivity. LAR of cancer mortality according to the LNT-model for paediatric chest CT or CT abdomen was 0.1 and 0.2 ‰. Including the γ-H2 AX foci data, the LAR is 8-10 times higher.
Conclusion: Even when low dose equipment and specific protocols are used CT X-rays induce DNA-damage in children. The present study emphasises the need for justification and dose optimisation in paediatric radiology.

B-0952 14:09

Optimising the balance between radiation dose and image quality in paediatric head CT: findings before and after intensive radiological staff training

L. Faggioni, F. Paolicchi, L. Bastiani, S. Molinaro, M. Puglioli, D. Caramella, C. Bartolozzi; *Pisa/IT (lfaggioni@sirm.org)*

Purpose: To assess radiation dose and image quality of paediatric head CT examinations before and after radiological staff training.
Methods and Materials: 215 contrast-unenhanced head CT examinations were performed in outpatients aged between 1 month and 14 years old before and after intensive training of staff radiologists and technologists to optimisation of CT technique. Patients were divided in three age groups (0-4, 5-9, and 10-14 years old), and pre- and post-training CT dose index (CTDI), dose-length product (DLP), tube voltage (kV), and tube current per rotation (mAs) values were retrieved from our hospital PACS. Pre- and post-training grey matter conspicuity and contrast-to-noise ratio were calculated, and subjective image quality in terms of artefacts, grey/white matter differentiation, noise, visualisation of posterior fossa structures, and need for repeat CT examination was visually evaluated by three neuroradiologists.
Results: Median post-training CTDI and DLP values were significantly lower after than before training in all age groups (27 mGy and 338 mGy·cm vs 107 mGy and 1444 mGy·cm in the 0-4 years old group, 41 mGy and 483 mGy·cm vs 68 mGy and 976 mGy·cm in the 5-9 years old group, and 51 mGy and 679 mGy·cm vs 107 mGy and 1480 mGy·cm in the 10-14 years old group, respectively; $p < 0.001$). Post-training kV and mAs settings were significantly lower compared to pre-training levels ($p < 0.001$). Subjective post-training image quality was not inferior to pre-training levels for all items except for noise ($p < 0.05$), which however was never diagnostically unacceptable.
Conclusion: Radiological staff training can be effective in reducing radiation dose while preserving diagnostic quality of paediatric head CT examinations.

B-0953 14:18

European guidelines on paediatric chest x-rays: is our dedicated paediatric division able to fulfil the standards quantitatively and qualitatively?

S. Tschauner, M. Gübitz, R. Marterer, S. Weissensteiner, E. Sorantin; *Graz/AT (sebastian.tschauner@medunigraz.at)*

Purpose: As paediatric patients are more susceptible to radiation, correct collimation in chest X-rays helps to reduce unnecessary exposure. European guidelines from 1996 define a minimal field size from "just above the lung apices" to "T12/L1" plus tolerances of 2 cm. This study's aim was to check our division's performance in the qualitative standards and measure overexposures quantitatively.
Methods and Materials: A total number of 307 unprocessed digital chest images, acquired in June and July 2013, were selected for analysis. 14 studies were excluded because of patient age greater than 18 years. The remaining 293 included patients had mean age of 6.28 years (SD 4.88, 0 to 17.87 years). 58% were boys, 42% girls. Overexposed areas plus amount of tissue on all four sides were measured: Image analyses were done with a self-developed ImageJ (open source image processing program) macro script.
Results: Examined patients' chest films showed a mean areal overexposure of 51.58% (SD 14.04%, range 15.99% to 107.88%) and the overexposed areas included 70.33% (SD 10.31%) tissue on average. Areal overexposure was found to decrease significantly with age.
Only 1% (3 out of 293) of our images fulfilled all quantitative and qualitative parameters of the European guidelines.
Conclusion: In our samples we found a mean unnecessary overexposure by more than half. As only a small minority of our division's chest films met all European Commission criteria, constant and recurrent quality assurance is necessary. On the other hand the mentioned guidelines may potentially be too strict in some situations.

B-0954 14:27

Diagnostic reference ranges: a new quality improvement tool in paediatric CT of the abdomen

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Purpose: To develop diagnostic reference ranges (DRR) to be used as a quality improvement tool for individual practices to compare their size-specific dose estimates (SSDE) for 5 body widths (BW) with SSDE ranges from six children's hospitals.
Methods and Materials: A multicenter retrospective study was performed. CT doses from September 1 to December 1, 2009 in 939 paediatric patients and 954 scans were reviewed through the American College of Radiology Dose Index Registry. SSDE were measured at the level of the splenic vein in transverse diameter. An appropriate dose range for each of 5 BW was developed by reviewing image quality on a subset of CT scans and compared to a 5 point reference scale created with the addition of simulated quantum mottle.
Results: For 954 scans, DRR (SSDE mGy) were 5.8-12.0, 7.3-12.2, 7.6-13.4, 9.8-16.4, 13.1-19.0 mGy for BW less than 15, 15-19, 20-24, 25-29, and 30 cm or greater.
Conclusion: DRR developed by a consortium of 6 children's hospitals (QUIRCC) address the balance between a patient's risk (radiation dose) and benefit (diagnostic image quality) and may be used by a local facility to compare their practice to the QUIRCC ranges for the purpose of quality improvement. Goske MJ et al. Radiology 2013; 268:208-218.
Author Disclosures:
D. Larson: Patent Holder; Guidance. **D. Frush:** Consultant; GE.

B-0955 14:36

Optimisation of image reconstruction method with sinogram affirmed iterative reconstruction in pediatric CT: chest, abdomen and head

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Purpose: To evaluate the image quality and clinical efficacy of pediatric CT using a recently available sinogram affirmed iterative reconstruction (SAFIRE) compared with filtered back-projection (FBP).
Methods and Materials: From january to march 2013, 82 of pediatric CT examinations were retrospectively divided into three groups which are based on each anatomic region of abdomen, chest and head. each image was reconstructed in soft tissue kernel by using standard FBP and 3 strength of SAFIRE among 5 different SAFIRE strengths. a phantom study with same protocol was also performed to analyse the relationship of noise reduction among 5 different SAFIRE strengths on average.
Results: Three-strength of SAFIRE can reduce image noise by 23.73% in chest (mean, 8.04), and 28.13% in abdomen (mean, 7.58) compared with each FBP (each mean, 11.09 and 10.81). on the other hand, noise reduction showed 15.53% in head (mean, 4.98) compared with FBP (mean, 6.30). in phantom study, noise reduction patterns were similar to clinical patient's data. the average noise reduction was as follows: 32.99% in chest CT, 27.78% in abdomen CT and 18.54% for head CT, respectively. the figure of noise reduction with five-strength of SAFIRE in head CT was similar to noise level with three-strength of SAFIRE in chest and abdomen CT.
Conclusion: A choice of the appropriate iterative method is necessary to achieve an optimal balance for image quality. when five-strength of SAFIRE is utilised in pediatric head CT, the level of noise reduction is similar to three-strength of SAFIRE in pediatric body CT.

B-0956 14:45

Evaluation of organ-specific dose reduction in paediatric chest computed tomography

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Purpose: To assess the impact of a novel Organ-Specific Dose Reduction (OSDR) algorithm on image quality of pediatric chest computed tomography (CT).
Methods and Materials: Twenty pediatric patients (8 male, 12 female; mean age 12.4 ± 5.6 years (range 3-17 years)) undergoing contrast-enhanced chest CT examinations on a 128-row-CT scanner were included. CT scans were performed at 100 kV using automated tube current modulation and a novel OSDR algorithm (XCare, Siemens AG, Forchheim, Germany). Nine patients had a previous chest examination performed on a 64-row-CT scanner at 100 kV without the OSDR algorithm. Subjective image quality was assessed using a five-point-scale (1- not diagnostic; 5- excellent) in all patients. In 9 children who underwent CT scans with and without OSDR, contrast-to-noise ratio (CNR) and signal-to-noise ratio (SNR) were determined in the aorta.
Results: In 20 patients, mean subjective image quality was 4.3 ± 0.7. In 9 patients that were also examined without OSDR, subjective image quality was

comparable with OSDR (4.4 ± 0.5) and without OSDR (4.4 ± 0.7)(p> 0.05). Furthermore, there was no significant difference in mean SNR and CNR of the aorta with OSDR (31.6 ± 17.1 and 22.3 ± 15.0, respectively) and without OSDR (27.4 ± 13.3 and 18.8 ± 12.4, respectively) (p> 0.05). CTDIvol was comparable for acquisitions with OSDR (2.3 ± 0.9 mGy) and without OSDR (2.6 ± 1.9 mGy)(p> 0.05).
Conclusion: Organ-specific dose reduction can be recommended for pediatric chest CT in order to reduce the radiation exposure to radiosensitive tissues as the breast or thyroid gland
Author Disclosures:
G. Antoch: Speaker; Siemens Medical Solutions, Bayer Healthcare, BTG.

B-0957 14:54

Image quality and reconstruction time of CT angiography with model-based iterative reconstruction in newborns and infants with congenital heart disease
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Purpose: To evaluate image quality and reconstruction time of CT angiography (CTA) with model-based iterative reconstruction (MBIR) in newborns and infants with congenital heart disease (CHD) and to compare with filtered back projection (FBP), adaptive statistical iterative reconstruction (ASIR)
Methods and Materials: Thirty-six consecutive children (age 4.79 ± 3.7 months, weight 4.79 ± 0.47 kg) with suspected or confirmed CHD underwent 64 detector MDCT (Discovery 750HD, GE health care) without ECG gating (80 kVp, 30-40 mA using tube current modulation).The CT images were reconstructed with FBP, ASIR and MBIR. Both objective and subjective image quality (4 point scale) were compared according to reconstruction method. In addition, each reconstruction time was also reported
Results: Images from all patients were diagnostic acceptable and total DLP was 0.06 mSv. HU of MBIR was significantly higher than other two reconstruction methods in ascending aorta and descending aorta ($p < 0.05$) and image noise of MBIR was significantly lower than other two methods in all chamber and great vessels ($p < 0.05$). On the other hand, each subjective image quality were 3.72 in FBP, 3.89 in ASIR, 3.84 in MBIR, respectively and statistically insignificant ($p > 0.05$). Each mean reconstruction time was 5.1 seconds in FBP, 5.1 seconds in seconds, 15.1 minutes in MBIR, respectively.
Conclusion: CTA with MBIR did not make a difference subjective image quality and needed relatively long reconstruction time in the evaluation of CHD, although image noise of MBIR was significant lower than one of FBP and ASIR

B-0958 15:03

Effect of tube voltage reduction on radiation dose and image quality in paediatric thoracic 256 multidetector computed tomography
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Purpose: To determine the effect of lowering tube-voltage on radiation dose and image quality in chest MDCT in children.
Methods and Materials: 30 children aged 2-10 years (6.8±2.2 years), weighting 12-30 kg (21.5±5.1 kg) underwent 256 chest MDCT. Acquisition parameters were: tube-voltage 100 kV; reference current 130 mAs with attenuation-based-tube-current-modulation; pitch 3; rotation-time 0.28 s; collimation 3x 0.6 mm; image reconstruction-thickness 3 mm; position-increment 3 mm. A second group of 30 patients with similar characteristics (age range: 2-10 years; mean: 6.2±2.1 yy; weight range: 12-30 kg; mean: 20.9±5 kg)underwent chest MDCT with the same parameters, except tube voltage: 80 kV. Image quality, artefacts, diagnostic confidence were evaluated for the 2 groups by 2 radiologists in consensus, blind to kV, using a 5-point-grading-scale (1=unacceptable; 5= perfect). Image noise was calculated by placing a region of interest at ambient air at the same 3 levels (aortic arch, carina, the first slice in which right diaphgram is visible) measuring the average of the standard deviations in HU. Effective doses were calculated using DPL method with accepted age-dependent-convertion-factors.
Results: Mean image quality, artefacts and diagnostic confidence were for group 1 vs group 2: 4.6±0.5 vs 4.5±0.6, 4.6±0.4 vs 4.4±0.5; 4.7±0.4 vs 4.5±0.5, without statistically significant difference (p=0.19, 0.11, 0.14, respectively). Mean image noise was 12.9±5 HU for group 1 and 13.4±6 for group 2 (p=0.22). Mean effective radiation doses in the 2 groups were statistically different: 1.4±0.7 mSv vs 0.8±0.2 mSv (p=0.01).
Conclusion: Our findings support the practice of lowering tube-voltage to 80 kV for paediatric chest MDCT.

B-0959 15:12

Definition of a scoring system for assessment of skeletal age using MRI of hand and wrist in healthy male children
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Purpose: To evaluate skeletal age determination, using Magnetic Resonance Imaging (MRI) of hand and wrist by creating a scoring system method.
Methods and Materials: 96 healthy young male (mean age 14.2±3.7; range 1y 6m to 19y 1m). Two operators (A, B) prior in consensus established a prototype of scoring system to establishing MRI skeletal age using as basis the anner and Whitehouse x-ray method. The scoring system was based on different grade of maturity carpal bones (range from 1 to 12 grades). To test the method two operators in double blind assigned a MRI skeletal age. Correlation between chronological age and MRI skeletal age was determined by linear regression analysis (R^2). k-Cohen was used to measure inter-observator variability and inter-rater reproducibility. Spearman' correlation coefficient (r) was used to analyse each carpal bone stage development.
Results: A strong positive linear correlation was obtained between MRI skeletal age and chronological age (R^2=0.976, 0.978; A, B respectively)). k-Cohen test demonstrated a pretty good values (reproducibility=0.6 and repeatability =0.7). The Radius and Ulna showed the strongest correlation with the MRI skeletal age (r=0.96 and 0.963 p=< 0.0001). A good linear correlation between sum of the scoring system and chronological age was observed (R^2=0.96).
Conclusion: MRI skeletal age estimation can be potentially used as a clinical tool to identify with more details cartilage and bone ossification during skeletal development. A non-invasive method to determinate bone age is clinically important in children to avoid radiation exposure.

B-0960 15:21

ECG-gated CT angiography in 324 consecutive pediatric patients: predictors of radiation dose
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Purpose: We aimed to identify the main determinants of radiation exposure from pediatric ECG-gated CTA.
Methods and Materials: Between June 2005 and June 2013, 324 ECG-gated CTAs were performed to evaluate pediatric patients with known or suspected cardiovascular abnormalities (median age 8.1 years). The effective dose (ED) was calculated from the dose-length product (DLP) using age-specific correction factors. The patients' age and average heart ratie during the scan, the method of ECG-synchronisation, tube potential (kV) and effective tube current (mAs) were analysed in univariate and multivariate regression analysis to identify predictors of radiation dose.
Results: Overall, the median ED was 1.85 mSv (range: 0.07 - 30.7 mSv). Median radiation exposure decreased from 13.38 mSv for patients examined in the years 2005-2007 to 1.25 mSv for patients examined in the years 2011-2013 ($p < 0.001$). Patients scanned using a tube potential of 80 kV (n=259) had a significantly lower median radiation dose (1.41 mSv, range 0.07-8.64 mSv) compared to patients who were scanned at 100 kV (n=46, median 6.3 mSv, range 1.26-14.83 mSv) or 120 kV (n=19, median 18.63 mSv, range 4.28-30.67 mSv, $p < 0.001$). On multivariate analysis, tube voltage, followed by tube current and the method of ECG-synchronisation were the strongest independent predictors of radiation dose.
Conclusion: The radiation exposure from pediatric ECG-gated CTA has decreased dramatically in recent years. With dedicated pediatric protocols, ECG-gated CTA can now be routinely performed with very low radiation exposure.
Author Disclosures:
U.J. Schoepf: Consultant; Bayer, Bracco, GE, Medrad, Siemens. Research/Grant Support; Bayer, Bracco, GE, Medrad, Siemens.

14:00 - 15:30 **Room E1**

Musculoskeletal

SS 1810

Knee osteoarthrosis

Moderators:
F.M. Buck; Zurich/CH
J. Labuscagne; Bunbury, WA/AU

B-0961 14:00

Subchondral bone oedema after matrix-assisted autologous chondrocyte transplantation: MRI evaluation at different follow-up times

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Purpose: Subchondral bone oedema is a common finding after cartilage treatment but its interpretation is still debated. The aim of this study is to analyse the presence of oedema after matrix-assisted autologous chondrocyte transplantation (MACT) for knee cartilage lesions at different follow-up times and its correlation with clinical outcome.
Methods and Materials: 116 patients (mean age 28.6±10.3 yrs) treated with MACT underwent 1.5-T MRI. 57 patients were affected by degenerative cartilage lesions, 27 traumatic and 32 OCDs (osteochondritis dissecans). MRI follow-up was performed from 1 to 5 years after treatment. A standard sequence protocol was optimisated for the study of articular cartilage and subchondral bone. Other than its presence or absence, the subchondral oedema was evaluated using a 3-level grading considering extension and hyper-intensity, and with the WORMS score oedema classification. IKDC subjective score was collected at the time of every MRI.
Results: Subchondral oedema presents a particular and well-defined trend during the follow-up: it was present in the first period and markedly reduced or disappeared at 2-3 years. Afterwards level of oedema increased again and remained steadily present at medium/long-term follow-up. Patellar lesions presented significantly lower oedema, whereas OCDs presented an increasing level of oedema over time. No correlation found between oedema and clinical outcome.
Conclusion: Edema after MACT is present during the first phases to 2 years of follow-up, and then tends to disappear. Less oedema was found in patella, whereas more oedema was found in OCDs. Interestingly, presence of oedema was not correlated with poorer clinical outcome.

B-0962 14:09

Meniscal lesions and effusion synovitis assessed by semiquantitative MRI strongly predict quantitatively measured cartilage thickness loss over 30 months: multicenter osteoarthritis study

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Purpose: Aims were to examine which pathological MRI and radiographic features of knee osteoarthritis (OA) are most predictive of quantitative cartilage thickness loss measured by MRI.
Methods and Materials: A subcohort of 196 subjects from the MOST participants had baseline and 30-month knee MRIs, quantitative cartilage thickness measurement, and semiquantitative scoring (Whole Organ MRI Score) of cartilage, bone marrow, meniscus, effusion-synovitis, and Hoffa-synovitis at both time points. Radiographic joint space narrowing (JSN) was assessed at baseline. Knees were classified into progressors (those who lost cartilage thickness above thresholds) and non-progressors. MRI predictors were dichotomized into present or absent. Differences in baseline scores of ipsicompartmental predictor variables were compared between progressors and non-progressors by logistic regression. Odds ratios (OR) were calculated for medial (MFTC) and lateral femorotibial compartment (LFTC) cartilage loss. We combined MFTC and LFTC to calculate ORs of ipsicompartmental cartilage loss across compartments.
Results: Of 196 knees (mean age 59.8±6.3, BMI 29.5±4.6), 46 had radiographic OA at baseline. Compared to non-progressors (n=149), progressors (n=47) had higher adjusted OR (aOR) for having baseline medial meniscal damage (MD) (aOR 2.4 [95%CI 1.2-5.1]), medial meniscal extrusion (ME) (aOR 2.5 [1.2-5.3]) and effusion-synovitis (aOR 3.2 [1.2-8.2]) in MFTC. In LFTC, baseline JSN (aOR 7.0 [1.8-27.1]), lateral MD (aOR 8.1 [2.5-26.6]) and lateral ME (aOR 4.1 [1.4-12.5]) predicted cartilage loss. In analysis combining MFTC and LFTC, results were similar to LFTC, with baseline compartment specific JSN, MD/ME predicting cartilage loss.
Conclusion: Meniscal damage/extrusion and effusion-synovitis assessed by semiquantitative MRI strongly predict quantitatively measured cartilage thickness loss over 30 months.

Author Disclosures:
A. Guermazi: Consultant; TissueGene, Merck Serono, Sanofi Aventis. Shareholder; Boston Imaging Core Lab. **F. Eckstein:** CEO; Chondrometrics GmbH. Consultant; MerckSerono, Abbvie. Owner; Chondrometrics GmbH. **F.W. Roemer:** Consultant; MerckSerono, NIH. Shareholder; Boston Imaging Core Lab. **L. Sharma:** Grant Recipient; NIH. **D. Felson:** Grant Recipient; NIH.

B-0963 14:18

Knee pain and inflammation in the infrapatellar fat pad estimated by conventional and dynamic contrast-enhanced magnetic resonance imaging in obese patients with osteoarthritis: a cross-sectional study

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Purpose: To investigate the association between knee pain and signs of inflammation in the infrapatellar fat pad (IPFP) in obese patients with knee osteoarthritis (KOA).
Methods and Materials: In a cross-sectional setting, 3-T conventional contrast-enhanced (CE) magnetic resonance imaging (MRI) and dynamic contrast-enhanced (DCE) MRI of KOA were analysed to quantify the extent of inflammation in the IPFP, and correlated to self-reported outcomes on pain, symptoms and quality of life assessed via the Knee injury and Osteoarthritis Outcome Score (KOOS). The extent of inflammation in the IPFP was assessed according to MOAKS (MRI Osteoarthritis Knee Score) using CE-MRI and by perfusion variables using DCE-MRI. The perfusion variable, "Inflammation", Σ IRE x (N-plateau+N-washout), was chosen as primary perfusion variable in the analysis.
Results: MRI and clinical data were obtained in 95 patients. The typical patient participating in this study was a 65-year-old woman with a body mass index of 32 kg/m^2. The bivariate association between KOOS pain and the DCE-MRI perfusion variable "Inflammation" showed a statistically significant correlation ($r=-0.42$, $p < 0.0001$). Furthermore, a statistically significant correlation was found between KOOS pain and MOAKS Hoffa-synovitis ($r=-0.21$, $p=0.046$). Intraclass correlation coefficients for the perfusion variables ranged from 0.81 to 0.99.
Conclusion: Perfusion variables on DCE-MRI reflecting inflammation in the IPFP and MOAKS Hoffa-synovitis were related to pain in obese patients with KOA. These results suggest that increasing inflammation in the IPFP is associated with increasing pain in KOA and that DCE-MRI is a robust and reproducible method to study the impact of inflammation in KOA.
Author Disclosures:
D. Hunter: Other; DH has received royalties from DJO. **R. Bouert:** Other; RB has acted as independent non-paid clinical advisor for Image Analysis Ltd, London. **M. Boesen:** Other; MB has acted as independent non-paid clinical advisor for Image Analysis Ltd, London.

B-0964 14:27

Dynamic contrast-enhanced MRI in patellofemoral pain syndrome: perfusion quantification of patellofemoral joint tissues

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Purpose: Patellofemoral pain syndrome (PFPS) is a common knee pathology with unknown aetiology. A hypothesis on the aetiology is a disturbed blood flow in the patellofemoral joint. Dynamic contrast-enhanced MRI (DCE-MRI) enables us to study perfusion, but there is no tailored method for the patellofemoral joint yet. In this study, we developed and evaluated a DCE-MRI protocol with dedicated post-processing tool, enabling perfusion quantification of patellofemoral joint tissues in order to disentangle the aetiology of PFPS.
Methods and Materials: We evaluated our method in 5 control subjects from an ongoing DCE-MRI study in PFPS and control subjects. Sagittal DCE image slices with SI phase encoding were acquired at 3 T using a 8-channel knee coil. Our volume of interest (VOI) consisted of the patellar bone. Motion between scans was corrected for by automated image registration. Voxel-wise quantitative perfusion parameters (kep) were calculated with Tofts model. Since precision of kep varies spatially, weighted mean and standard deviation were computed over the VOI, with weights given by the reciprocal Cramér-Rao-Lower-Bound (indicating fit uncertainty).
Results: Weighted mean kep values of the patellar bone ranged between 0.045 and 0.071 s^{-1}, which is in correspondence with the literature. The mean weighted standard deviation in the VOI was 0.031 s^{-1}, suggesting heterogeneous perfusion within the patella.
Conclusion: The results suggest that our DCE-MRI protocol and post-processing tool are adequate, and can be used to study patellar blood perfusion. Quantitative kep maps even allow study of regional perfusion. This may yield important information on the aetiology of PFPS.

B-0965 14:36

Diffusion-weighted imaging for the assessment of knee synovitis: a comparative study against contrast-enhanced MRI

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Purpose: MRI of synovitis currently requires contrast-enhanced imaging which increases cost, risks, and imaging time. The novel 3D double echo steady state (DESS) sequence can be modified by increasing diffusion weighting, thereby improving contrast between synovium and joint fluid. Our purpose was to compare DESS with contrast-enhanced (CE) MRI for knee synovitis assessment.
Methods and Materials: Nine individuals with symptomatic inflammatory knee arthritis underwent MRI at 3.0 T. Routine clinical sequences were performed followed by the modified 3D DESS sequence (matrix 256x256; slice thickness 3 mm; duration 5:00 minutes) with high diffusion (10 cycles/voxel) gradient and CE T1-weighted imaging (matrix 384x256;slice thickness 3 mm; duration 4:30 minutes). DESS and CE MRI images were scored independently by a blinded musculoskeletal radiologist. Synovitis was graded semiquantitatively at 11 sites and a whole-joint sum score was calculated according to Guermazi etal. Agreement statistics were calculated on site and patient levels and whole-joint synovitis scores of DESS were correlated with those of CE MRI (reference).
Results: DESS showed good agreement (86% and 77% based on analysis on patient and site level respectively) with CE MRI for detection of synovitis, but systematically underestimated synovitis severity (61% absolute agreement analysed by site). Excellent correlation was found between summed whole-joint synovitis scores of DESS and CE MRI (Pearson's correlation coefficient 0.85 (p=0.016), intra-class correlation coefficient 0.82 (95%CI 0.28-0.97)).
Conclusion: Diffusion weighted imaging with a modified 3D double echo steady state (DESS) sequence with high diffusion gradient is promising for the (semiquantitative) assessment of knee synovitis without need for contrast agents.
Author Disclosures:
B.A. Hargreaves: Research/Grant Support; General Electric Healthcare. **G.E. Gold:** Consultant; Zimmer, Boston Scientific, Isto Inc. Research/Grant Support; General Electric Healthcare.

B-0966 14:45

Relationship of total hip arthroplasty to ipsilateral and contralateral knee osteoarthritis: a 4-year longitudinal 3 T MRI study from the osteoarthritis initiative

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Purpose: To evaluate the association of unilateral total hip arthroplasty (THA) with the prevalence and worsening of OA degenerative changes and strength in the ipsilateral and contralateral knee.
Methods and Materials: We studied both knees of 30 individuals in the osteoarthritis Initiative (OAI) with prevalent unilateral THA at baseline. We compared knees ipsilateral and contralateral to THA within each subject on baseline values, and change over 4 years, in Western Ontario and McMasters Universities Arthritis Index (WOMAC) scores, upper leg isometric strength, whole-organ MR imaging scores (WORMS) and (in right knees) cartilage T2 relaxation time measurements. Ipsilateral and contralateral knees were compared using multivariate regression models and paired t-tests.
Results: WOMAC scores did not differ between knees at baseline, but there was a trend for greater contralateral knee worsening of WOMAC pain (paired t-test, P=0.087), stiffness (P=0.039), physical function (P=0.057) and total scores (P=0.059) in subjects with unilateral THA. Strength did not differ between knees at baseline, but contralateral extension strength declined more over 4 years (P=0.037) than ipsilateral. Contralateral knees had higher cartilage scores (P=0.007) and total WORMS scores (P=0.008) at baseline. Total WORMS score also showed greater worsening over 4 years (P=0.008). Baseline T2 was not significantly different between knees, but T2 values increased more in knees contralateral to THA (mean±SEM, 2.9±1.4 ms versus 0.2±1.1 ms; P=0.007).
Conclusion: THA is associated with an increased progression of degenerative findings in the contralateral knee compared to the ipsilateral knee.

B-0967 14:54

Association of T2 relaxation time measurements with different grades of radiographic knee osteoarthritis over 48 months - data from the Osteoarthritis Initiative

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Purpose: To analyse the cross-sectional and longitudinal association between cartilage biochemical composition (as measured by MRI T2) and various stages of radiographic OA as defined by Kellgren-Lawrence (KL-)score.
Methods and Materials: Right knee 3 Tesla MRI studies of 190 subjects (105 female, 85 male, aged 45-70, BMI 24.7±2.4) from the Osteoarthritis Initiative were selected based on their baseline radiographic KL-readings and stratified into 4 KL-groups (KL 0-3). Knee cartilage was segmented at baseline, 2-year and 4-year follow-up. Mean cartilage T2 quantification as well as laminar- and GLCM-texture analysis were performed at each timepoint. Global mean T2 values and T2 changes over time were calculated for each KL-group. Regression models adjusted for age, gender, and BMI were used to determine the difference in cartilage T2 parameters between KL-groups.
Results: Subjects with KL-grades of 1, 2 or 3 showed significantly higher global mean T2 values than subjects with KL0, at baseline ($p < 0.005$; $p < 0.001$, $p < 0.001$), at 24 months (p=0.001; $p < 0.001$, p=0.044) and 48 months ($p < 0.001$; p=0.002, $p < 0.001$). Texture and laminar cartilage analyses revealed additional significant T2-differences between KL1 and KL3 (p=0.004) and KL2 and KL3 (p=0.031) at most timepoints. The annual increase in mean T2 was similar for each KL-group and ranged from 0.36 ms/yr in KL1 subjects to 0.25 ms/yr in KL3 subjects (p=0.61).
Conclusion: Our findings suggest that T2 relaxation time measurements, and particularly laminar and texture cartilage analyses, can depict different degrees of osteoarthritis related cartilage damage cross-sectionally and longitudinally, and might therefore be promising tools to monitor osteoarthritis progression.

B-0968 15:03

Delayed gadolinium-enhanced MRI of the Meniscus (dGEMRIM) in patients with knee osteoarthritis: relation with meniscal degeneration on conventional MRI, reproducibility, and correlation with dGEMRIC

J. van Tiel, G. Kotek, M. Reijman, P.K. Bos, S. Klein, J.A.N. Verhaar, G.P. Krestin, H. Weinans, E.H.G. Oei; *Rotterdam/NL (e.oei@erasmusmc.nl)*

Purpose: (I) To assess if menisci identified as normal or degenerated on conventional MRI differ in T1 relaxation times of delayed gadolinium-enhanced MRI (T1GD), (II) to assess the reproducibility of T1GD of the meniscus and (III) to assess the correlation between T1GD of the meniscus and the articular cartilage in knee osteoarthritis (OA) patients.
Methods and Materials: In 17 OA patients who underwent delayed gadolinium-enhanced MRI twice within 7 days, we calculated T1GD in the medial and lateral anterior and posterior meniscus and femoral and tibial cartilage. Meniscus pathology was evaluated on conventional MRI. T1GD in normal and degenerated menisci were compared using an unpaired t-test. Reproducibility of T1GD was assessed using intraclass correlation coefficients (ICC). Pearson's correlation coefficient was calculated between meniscus and cartilage T1GD.
Results: A trend towards lower T1GD in degenerated menisci (mean: 448 ms, 95%CI: 423-473 ms) compared to normal menisci (mean: 402 ms, 95%CI: 359-444 ms) was observed (p=0.05). ICCs of meniscus T1GD ranged from 0.85 to 0.90. The correlation between meniscus and cartilage T1GD was moderate in the lateral compartment (r=0.52-0.75) and strong in the medial compartment (r=0.78-0.94).
Conclusion: Degenerated menisci have a clear trend towards lower T1GD compared to normal menisci. Since these results are highly reproducible, meniscus degeneration might be assessed within one delayed gadolinium-enhanced MR examination simultaneously with articular cartilage. The strong correlation between meniscus and cartilage T1GD indicates concomitant degeneration in both structures in OA, but also suggests that dGEMRIC may not be regarded entirely sulphated glycosaminoglycan specific.
Author Disclosures:
G.P. Krestin: Consultant; General Electric Healthcare. Grant Recipient; General Electric Healthcare.

B-0969 15:12

Knee joint space measurements on computer automatically aligned images vs conventional reconstructions

A. Chabra,[1], Z. Peng[2], X. Zhou[2], C. Florin[2]; [1]*Dallas, TX/US*, [2]*Malvern, PA/US (zhigang.peng@siemens.com)*

Purpose: To evaluate the time and measurement differences for the interpretation of knee joint space measurements on computer auto-aligned CT images versus conventional reconstructions.
Methods and Materials: 30 randomly selected CT scans of the knee (mean age 51 yrs, range 12-76 yrs), all performed on 64-slice scanner, reconstructed at 0.75-3 mm slice thickness. These scans were reviewed by experienced musculoskeletal radiologist who measured joint space in the medial, lateral and patella-femoral compartments of the knee on conventional coronal and axial images (CCT). The same measurements were then performed on computer auto-aligned CT images (ACT) obtained by an algorithm prototype using anatomical landmarks to reorient the images for optimal display of the knee joint space. Differences in joint space measurements and time for evaluation were assessed.
Results: The mean medial-tibio-femoral space on CCT was 3.2 mm (range 1.1-8.2 mm, SD-1.4 mm), and on ACT was 3.2 mm (range 1.1-7.9 mm, SD-1.5 mm) (p-value 0.06). The mean lateral-tibio-femoral space on CCT was 4.5 mm (range 1.5-7.9 mm, SD-1.6 mm), and on ACT was 4.7 mm (range 1.5-11.1 mm, SD-2.3 mm) (p-value 0.30). The mean lateral-patella-femoral space on CCT was 3.2 mm (range 1.4-5.8 mm, SD-0.9 mm), and on ACT was 3.3 mm (range 1.5-6.8 mm, SD-1.3 mm) (p-value 0.20). The mean time for evaluation of the three measurements on CCT was 47.6 sec (range 27-110 sec, SD-15 sec), and on ACT was 33.8 sec (range 25-77 sec, SD-10 sec). The difference was statistically significant (pvalue< 0.001).
Conclusion: Computer auto-alignment of CT image reconstructions (ACT) allows significantly faster evaluation time without statistically significant impact on the results of joint space measurements. It can save radiologists' time and potentially lead to cost savings.
Author Disclosures:
A. Chhabra,: Consultant; Siemens Medical Solutions USA, Inc. **Z. Peng:** Employee; Siemens Medical Solutions USA, Inc. **X. Zhou:** Employee; Siemens Medical Solutions USA, Inc. **C. Florin:** Employee; Siemens Medical Solutions USA, Inc.

B-0970 15:21

Weight-bearing CT of the knee: does the joint alignment change from supine to upright position?

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Purpose: To compare patellofemoral and femorotibial joint alignment in supine non-weight-bearing (NWBCT) and upright weight-bearing computed tomography (WBCT).
Methods and Materials: Institutional review board approval and informed consent of all patients were obtained. NWBCT and WBCT scans of the knee were obtained of 26 patients (mean age, 57.0 ± 15.9) using a 64-row CT for NWBCT and a novel cone-beam extremity CT for WBCT. Two musculoskeletal radiologists quantified joint alignment by measuring femorotibial rotation, tibial tuberosity-trochlear groove distance (TTTG), lateral patellar tilt angle (LPTA), lateral patellar shift (LPS), and medial and lateral femorotibial joint space width. Significant differences between NWBCT and WBCT were sought using Wilcoxon signed-rank test. P values < 0.05 were considered statistically significant.
Results: Significant differences were found for femorotibial rotation (P=0.051/P=0.009;reader 1/reader 2), TTTG (P=0.008/P=0.002), LPTA (P=0.011/P=0.188) and medial joint space width (P=0.003/P=0.004). Femorotibial rotation changed from NWBCT (mean 0.0° ± 6.1 internal rotation) to WBCT (3.6° ± 6.8 external rotation). TTTG decreased from NWBCT (13.8 mm ± 5.1/13.8 mm ± 3.9) to WBCT (10.5 mm ± 5.0/10.9 mm ± 5.2). LPTA decreased from NWBCT (15.6° ± 6.7/16.9° ± 7.4) to WBCT (12.5° ± 7.7/15.0° ± 6.2). The medial femorotibial joint space decreased from NWBCT (3.9 mm ± 1.4/4.5 mm ± 1.3) to WBCT (2.9 mm ± 2.2/3.5 mm ± 2.2). Interreader agreement was in average good to excellent (0.42-0.88).
Conclusion: Knee joint alignment significantly changes in the upright weight-bearing position using CT.

B-0971 15:30

Quantitative assessment of biological expression and physiological imaging in the experimental osteoarthritis

W. Yao; *Shanghai/CN (yaoweiwu@yahoo.com)*

Purpose: To evaluate the relations among the level of cytokines in rabbits' serum, quantitative parameters of MR physiological imagings (T2, T2* relaxation time) and pathology of experimental osteoarthritis.
Methods and Materials: 18 New-Zealand White rabbits were manufactured to be animal models of experimental osteoarthritis, and divided into 6 groups by weeks (2, 4, 8, 12, 16, 20), another 6 rabbits as the control group by means of pseudosurgery. The concentration of BMP-2,CTX-II and COMP in rabbits' serum were recorded. Every left knee of each group was scanned by MR Pd-WI, T2 mapping and T2* mapping imaging accordingly and T2 and T2* values of the articular cartilage in 10 subregions based on the Whole-Organ MRI-Score were calculated. Differences were analysed and compared with the concentration of cytokines by biochemical analysis and HE staining.
Results: The T2 relaxation time were 21.33, 20.21, 17.85, 25.61 ms at the time of 8.12,16, 20 weeks after the surgery (P < 0.05, compared to their control groups, respectively). The mean T2* relaxation time was 9.07 ms before operation and elevated by 1.39.1.83, 3.33.14.6, 5.02, 3.31 ms, respectively, at different time points. They are closely related to the difference of BMP-2, CTX-II and COMP (r1=0.6, r2=0.72, r3=0.68). The difference of BMP-2 and CTX-II within every group was statistically significant. HE staining demonstrated that the proportion and extent of injured cartilage increased along with the prolonged moulding time.
Conclusion: The T2,T2* relaxation time can depict injury extent of articular cartilage of osteoarthritis and they are closely related to the concentration of BMP-2,CTX-II,COMP in the serum reflecting different periods of cartilage damage as well.
Author Disclosures:
W. Yao: Research/Grant Support; NSFC (No. 81171312).

14:00 - 15:30 **Room E2**

GI Tract

SS 1801b

Bowel imaging: advancing the use of US, CT and MRI

Moderators:
A. Graser; Munich/DE
C. Stoupis; Männedorf/CH

B-0972 14:00

Reducing image noise in CT colonography: effect of an integrated circuit CT detector

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Purpose: To investigate whether an integrated circuit (IC) CT detector results in reduced noise in CT colonography (CTC).
Methods and Materials: 366 consecutive patients underwent clinically-indicated CTC using the same CT scanner system, except for a difference in CT detectors (IC or conventional). Image noise, patient size, and scanner radiation output ($CTDI_{vol}$) were quantitatively compared between the patient cohorts for each detector system, with separate comparisons for the abdomen and for the pelvis.
Results: For the abdomen and the pelvis, despite significantly larger patient sizes in the IC detector cohort (both p < 0.001), image noise was significantly lower (both p < 0.001), whereas $CTDI_{vol}$ was unchanged (both p> 0.05). Based on the observed image noise reduction, radiation dose could alternatively be reduced by approximately 20% to result in similar levels of image noise.
Conclusion: CTC images acquired using the IC detector had significantly lower noise than using the conventional detector. This noise reduction can permit further radiation dose reduction in CTC.
Author Disclosures:
C.H. McCollough: Grant Recipient; Siemens Heatlthcare. **G. Michalak:** Employee; Siemens Medical Solutions. **J.G. Fletcher:** Grant Recipient; Siemens Heatlthcare.

B-0973 14:09

CT colonography with rectal iodine tagging: evaluation of diagnostic accuracy, patient acceptance and overall examination time

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Purpose: To assess diagnostic accuracy and image quality of CT colonography (CTC) with rectal iodine tagging.
Methods and Materials: Thirty-five asymptomatic patients with 57 colonic lesions sized 6-30 mm underwent CTC for colorectal cancer screening. Patient preparation consisted of a three-day low-residue diet plus Macrogol 4000 and Bisacodyl after lunch, followed by a 50 mL enema of diatrizoate dimeglumine (Gastrografin™) diluted in 300 mL warm tap water and automatic insufflation with 3L carbon dioxide immediately before CTC. CTC findings were compared with optical colonoscopy, and per-segment image quality was assessed using a semiquantitative score (1=poor, 2=adequate, 3=excellent). Tagging quality, patient acceptance, and total examination time of 80 unremarkable CTC studies (40 performed with rectal tagging and 40 with oral tagging) were evaluated.
Results: Overall tagging quality and patient acceptance were comparable with rectal and oral tagging, while total examination time was significantly lower with rectal tagging (18.3±3.5 vs 215.6±10.3 minutes, $p < 0.0001$). Per-segment image quality of CTC with rectal tagging was adequate to excellent in all colonic segments, with a sensitivity and specificity in lesion detection of 100% and 100% in the sigmoid-rectum, 100% and 96.7% in the descending colon, 100% and 89.3% in the transverse colon, and 100% and 95.2% in the caecum-ascending colon, respectively. Per-lesion sensitivity and specificity were 94.6% and 98.8% for lesions sized 6-9 mm, and 100% and 99.4% for lesions sized 10-30 mm, respectively.
Conclusion: Rectal iodine tagging can be an effective and well-tolerated alternative to oral tagging for CTC with the advantage of a substantially shorter overall examination time.

B-0974 14:18

Structured reporting of CT colonography examinations to support national data registries and outcomes analyses

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Purpose: Standardised reporting of CT colonography (CTC) is essential for the effective communication of diagnostic results, tracking of patient outcomes, outcomes analyses, and support of national data registries including the American College of Radiology's (ACR) CTC Data Registry. Various imaging systems exist for the creation and interpretation of 2D and 3D CTC images, but no standardised reporting methods have been proposed. We present a multimedia structured reporting solution, called ViSion, which can be used to standardise the reporting of CTC exams, code results with C-RADS criteria, and automate data entry into international registries.
Methods and Materials: We developed a multimedia structured reporting system, called ViSion, which can function with any CTC image display and interpretation workstation. ViSion tags key images captured from a CTC image processing system with metadata describing the anatomical location of a finding, radiological observation/diagnosis, and disease metrics. Furthermore, the radiological findings can be linked to pathology outcomes in graphical disease timelines to support outcomes analyses. The data contained within a ViSion structured report can be transported automatically into national data registries.
Results: We applied the ViSion structured reporting system to 100 CTC cases performed at our institution to create standardised CTC reports which were subsequently uploaded into the ACR's CTC Data Registry.
Conclusion: The practice of radiology is undergoing a transition from narrative reporting to structured reporting. We have developed a structured reporting system that can be used to standardise the reporting of CTC examinations, support international disease registries, and conduct data mining for outcomes analyses.
Author Disclosures:
D.J. Vining: CEO; VisionSR, Inc. Founder; VisionSR, Inc. Shareholder; VisionSR, Inc. **C. Popovici:** Employee; Eloquentix, Inc. **A. Pitici:** Employee; Eloquentix, Inc. **A. Prisacariu:** Employee; Eloquentix, Inc. **M. Jurca:** Employee; Eloquentix, Inc.

B-0975 14:27

MR colonography including diffusion-weighted imaging (DWI) in children and adolescents with inflammatory bowel disease (IBD): do we really need intravenous contrast?

S. Sirin, S. Kathemann, B. Schweiger, M. Hahnemann, M. Forsting, T.C. Lauenstein, S. Kinner; *Essen/DE (selma.sirin@uk-essen.de)*

Purpose: MR colonography (MRC) is a well-accepted, non-invasive imaging modality for the depiction of inflammatory bowel disease. Diffusion-weighted imaging (DWI) has been shown to show lesions in abdominal MRI as good as contrast-enhanced imaging and can also be used for bowel imaging. Aim of this study, therefore, was to assess if contrast enhancement is really needed to depict inflammatory lesions in bowel MRI if DWI is available.
Methods and Materials: 37 patients (23 girls, 14 boys, mean age 14.6years) underwent MRC on a 1.5 T (Magnetom Avanto, Siemens). In addition to T2-weighted and contrast-enhanced T1-weighted (ce-T1-w) data, DWI sequences in axial and coronal plane (b = 50,500.1000) were acquired. Two reviewers separately evaluated i) DWI, ii) ce-T1-w MRC as well as iii) DWI and ce-T1-w MRC concerning lesions (1=none,2=one/continuous lesion (s), 3=multiple, discontinuous lesions). Furthermore, bowel distension (1=good, 2=moderate, 3=poor) and preferred b-value were assessed. Colonoscopy (up to 48 hours afterwards) including biopsies served as reference standard.
Results: Depiction of inflammatory lesions significantly increased with DWI compared to T1-w MRC alone (sensitivity/specificity 78.4%/100% vs. 95.2%/100%, respectively, compared to colonoscopy/histopathology, $p < 0.001$). In six patients, lesions were only detected by DWI, in another six patients DWI detected additional lesions. Kappa values for the two readers were excellent (k=0.92-0.96). A combination of b=500 and 1000 was preferred for DWI.
Conclusion: DWI of the bowel shows inflammatory lesions with high accuracy and proved to show lesions that were not seen with ce-T1-w imaging. Therefore, DWI seems to be able to replace, in any case complement ce-T1-w MRC.

B-0976 14:36

MR enterocolonography: feasibility study

L. Tkalčić; *Rijeka/HR (lovro.tkalcic@gmail.com)*

Purpose: To evaluate feasibility of magnetic resonance enterocolonography (MREC) in patients with Crohn's disease.
Methods and Materials: We prospectively enrolled 108 consecutive patients, 65 men and 43 women diagnosed with Crohn's disease, mean age 41±14 years (age range, 17 - 68 years). After bowel cleansing patients ingested 1000 ml of the solution containing 0.5% of mannitol and 0.5% of milled carob prior to examination. Patients were examined in prone position and warm tap water enema was administered. HASTE, trueFISP, and VIBE sequences were acquired. Six bowel segments were independently analysed by two experienced radiologists. Bowel distension was assessed as poor, suboptimal but diagnostic, and excellent by consent.
Results: Excellent large bowel distension was acquired in 93%, 94%, and 97% of patients for ascending/transverse colon, descending/sigmoid colon, and anorectal segment, respectively. Ileocecal and ileal distension was excellent in 82%, and 88% of examinees. Jejunal distension was excellent in 46%, suboptimal but diagnostic in 43%, and poor in 11% of examinees. There was no significant correlation between gender, age or body mass index (BMI), and bowel distension. Four patients vomited (4%), and 24 examinees (22%) had more than three stools during the oral ingestion of contrast. Significant complications were not detected.
Conclusion: MREC is feasible. Optimal colonic, ileocecal, and ileal distension, fair overview of the jejunal loops, good patient's acceptance, and lack of radiation burden makes it promising diagnostic tool in diagnosis and follow-up of patients with Crohn's disease.

B-0977 14:45

CT enterography: comparison of dose-reduced CT with hybrid iterative reconstruction and routine-dose CT with filtered back projection for the evaluation of sigmoid diverticulitis

A. Laqmani[1], S. Veldhoen[2], S. Dulz[1], F.O. Henes[1], T. Derlin[1], F. Wassenberg[1], H.D. Nagel[3], G. Adam[1], M. Regier[1]; [1]*Hamburg/DE*, [2] *Würzburg/DE*, [3]*Buchholz/DE (a.laqmani@uke.de)*

Purpose: To assess image quality of dose-reduced CT enterography (CTE) reconstructed with hybrid iterative reconstruction (HIR) and filtered back-projection (FBP) to routine-dose examinations reconstructed with FBP in patients with suspected sigmoid diverticulitis (SD).
Methods and Materials: 30 patients with suspected SD underwent contrast-enhanced dose-reduced CTE (Brilliance iCT, tube voltage;120 kVp; mean CTDIvol: 9.9 mGy; mean DLP: 523.4 mGy*cm; mean BMI: 29). 30 patients, who had undergone routine-dose CTE (tube voltage;120 kVp; mean CTDIvol: 15.6 mGy; mean DLP: 852.7 mGy*cm; mean BMI: 30.5) served as reference.

Routine-dose CTE images were reconstructed with FBP, dose-reduced CTE images were reconstructed with FBP and the HIR iDose (Philips Healthcare) using two strengths (iDose4 and 6). Four independent radiologists evaluated image quality (1 [worst] to 5 [best]) including findings of SD. Objective image noise (OIN) was recorded, CNR was calculated. Statistical analysis was performed using t-test, random intercept model and ICC.
Results: In dose-reduced CTE, CTDIvol could be reduced up to 37% in comparison to routine-dose CTE ($p < 0.05$). HIR reduced the OIN in dose-reduced CTE of up to 58% compared to FBP. The lowest scores of subjective image quality were reached in dose-reduced CTE with FBP (2.7). Dose-reduced CTE with iDose4 was determined to be of equivalent image quality as routine-dose CTE with FBP (Scores: 4 vs. 4.3, respectively). Interobserver agreement was excellent (ICC: 0.91; $p < 0.05$).
Conclusion: HIR reduces image noise and improves image quality in dose-reduced CTE, thus allowing for a dose reduction of 37% in CTE with comparable image quality as routine-dose CTE.

B-0978 14:54

Submilisievert ultralow-dose CT colonography: comparison of filtered back projection and model-based iterative reconstruction technique

L. Lambert, J. Daneš, J. Jahoda, J. Hořejš; *Prague/CZ (lambert.lukas@gmail.com)*

Purpose: To evaluate diagnostic acceptability of ultralow-dose CT colonography.
Methods and Materials: Sixteen patients underwent CT colonography with standard protocol in supine position and ultralow-dose protocol in prone position. Supine datasets were reconstructed both with filtered back projection and advanced model-based iterative reconstruction technique. Two radiologists with experience in reading CT colonography independently evaluated 96 colonic segments in endoluminal view and axial thin sections. Diagnostic acceptability, colonic distension, smoothness of colonic wall, sharpness of colonic wall delineation, perceived image noise were rated on a five-point scale.
Results: All distended segments were rated evaluable in standard dose and ultralow-dose series reconstructed with iterative reconstruction technique, whereas 61% segments were rated inevaluable in ultralow-dose series where filtered back projection was used with worst ratings in the rectum and the sigmoid colon. The mean radiation dose was 0.42 mSv resp. 5.48 mSv in prone resp. supine scans.
Conclusion: Submilisievert CT colonography renders acceptable images when advanced model-based iterative reconstrution technique is used. Further investigations of larger scale need to be done to clarify, whether such a low-radiation dose would influence the detection of polyps.

B-0979 15:03

Low-dose CT scans of subjects smuggling illicit concealed packages at the UK border: a liquid situation

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Purpose: To identify subjects who have concealed illicit drugs at the UK border. Such drugs have typically been swallowed in the solid powder form concealed in packages such as condoms which can usually be detected by plain abdominal radiographs (AXR). Recently packages containing concealed illicit drugs in the liquid form have been encountered which are extremely difficult to detect using AXR. Very low-dose CT scans (VLDCT) were performed on subjects suspected of smuggling drugs in this form.
Methods and Materials: The UK Border Agency (UKBA) provided solid and liquid packages containing cocaine which had been recovered from subjects attempting to smuggle them into the UK. An improvised phantom was constructed to act as a virtual colon containing the solid and liquid packages which were imaged using AXR MRI and VLDCT.
Results: AXR identified solid packages as regular well-defined opacities though liquid packages were very difficult to identify using the phantom. MRI was of no benefit. VLDCT detected solid and liquid packages with ease despite liquid packages having irregular borders and contained air. 10 subjects considered suspicious for smuggling illicit concealed drugs by UKBA underwent VLDCT. 2 demonstrated solid packages 1 liquid packages 1 was a false positive the remainder negative. All positive cases showed similar appearances to those in the phantom.
Conclusion: This is the first report using VLDCT to detect concealed packages in the liquid form. VLDCT reliably detects illicit concealed packages in both the solid and liquid form with ease whilst imparting a low radiation dose.

B-0980 15:12

Right colonic diverticulitis: clinical and CT characteristics in a large series of Caucasian patients

L. Valbousquet Schneider[1], F.-X. Arnaud[2], E. Peroux[1], J. Potet[2], M. Zins[3]; [1]*Saint Mandé/FR*, [2]*Clamart/FR*, [3]*Paris/FR (laura.valbousquet@gmail.com)*

Purpose: To assess the clinical and CT-scan characteristics of right colonic diverticulitis (RCD) in a large, monocentric series of Caucasian patients in comparison with left colonic diverticulitis (LCD).
Methods and Materials: Two radiologists blinded to clinical information reviewed CT-scans of 30 consecutive patients with a final diagnosis of RCD and 70 consecutives patients with a final diagnosis of LCD, performed in our institution between July 2005 and February 2013 and between May 2010 and February 2013, respectively. Clinical features, CT-scan characteristics, type of treatment and follow-up were collected in all cases (n=100). Final diagnosis was established by an expert panel formed by 2 gastrointestinal surgeons and a gastrointestinal radiologist, with full access to clinical, laboratory, radiologic, pathologic and surgical findings, including a follow-up of at least 6 months.
Results: The median age was lower in RCD than in LCD patients (48 versus 64 years old, p 180°) and was more common in LCD compared to RCD (80% versus 33.3%, $p < 0.001$). CT signs of severity were less frequent in RCD compared to LCD; pericolonic abscess (3.3% versus 17.1%, p=0.06), detection of peritoneal free air (3.3% versus 18.6%, p=0.06). RCD were associated with less clinical complication (6.7% versus 25.7%, p=0.03), necessitating less emergency surgery (0% versus 2.9%, p=0.10) and had a lower recurrence rate compared to LCD (16.7% versus 34.3%, p=0.07).
Conclusion: Compared to LCD, RCD occurs in younger patients with a lower risk of complication or recurrence. An inflamed diverticulum is a more frequent finding in RCD.

B-0981 15:21

Technical feasibility and interobserver variability of elastosonography in the assessment of pathological bowel tracts

A. Colleoni[1], L. Romanini[1], V. Cantisani[2], P. Ricci[2], F. Calliada[3], M. Dal Corso[1], L. Grazioli[1], R. Maroldi[1]; [1]*Brescia/IT*, [2]*Rome/IT*, [3]*Pavia/IT (ale.colleoni@hotmail.it)*

Purpose: To investigate the feasibility of elastosonography (USE) and the inter-observer variability in the assessment of pathological bowel loops as compared with B-mode US (US).
Methods and Materials: We examined prospectively 41 consecutive patients with at least one thicked bowel loop. US and USE were performed by one expert Abdominal Radiologist with a GE E9. Images acquired by the operator were then evaluated by two other blinded radiologists, separately. Statistical analysis were performed with Cohen's K and Yates chi square tests. We considered: layering and echogenicity of bowel wall on B-Mode images; wall layering, definition of wall and peripheral tissues boundaries, and the rectus abdomins muscle pattern (as reference) on USE images.
Results: 46 pathological loops were examined: 38 at 5 MHz, 36 at 7.5 MHz and 31 with both frequencies. Overall 74 evaluations were performed; in all out of 10/74 (13.5%) an adequate elastogram was obtained. For the first reader, the agreement about bowel wall stratification between US and USE was fair, without statistically significant differences between the two frequencies (p=0.56). Among the three readers, a moderate agreement was found on B-Mode images about bowel wall layering and echogenicity. On USE images Cohen's test provided a moderate agreement for layering; a slight agreement, instead, was found for bowel wall and peripheral tissues boundaries, and in the evaluation of rectus abdominis muscle.
Conclusion: USE evaluation of pathological bowel walls is feasible. A moderate agreement among the three Radiologists was found. Further studies will define the clinical role of this tool.

14:00 - 15:30 **Room F1**

Oncologic Imaging

SS 1816

Tumour characterisation: methodological aspects and clinical prospects

Moderators:
L.S. Fournier; Paris/FR
N.N.

B-0982 14:00

Multiparametric quantitative MRI in neurooncology: impact of single parameters on overall accuracy

M. Dietzel[1], B. Volbers[1], P.A.T. Baltzer[2], S. Kloska[1], T. Struffert[1], T. Engelhorn[1], S. Lettmaier[1], R. Fietkau[1], A. Dörfler[1]; [1]*Erlangen/DE*, [2]*Vienna/AT*

Purpose: Multiparametric quantitative MRI provides a large range of measures for tissue characterisation. Interestingly, knowledge on the additional diagnostic-value of each single parameter and knowledge on the overall diagnostic accuracy of all parameters in combination is still limited.
Methods and Materials: Patients were investigated using a clinical MR-scanner (Siemens Magentom Aera, B_0=1.5T) applying DTI (diffusion tensor imaging), DWI (diffusion weighted imaging) as well as DCE sequences (dynamic contrast enhanced; after i.v. injection of 6 ml Gadovist @2 ml/s). For multiparametric quantitative assessment of the tumors k^{trans}, k^{ep}, V_e (DCE: Tofts-Modell), ADC (DWI) und FA (DTI) were calculated using appropriate post-processing software. Clinical follow-up as well as histopathology served as reference-standard (fifteen malignant and non-malignant brain tumors). All quantitative MR-parameters were analysed by means of uni- and multivarate statistics and were correlated with the reference-standard (malignant vs. non-malignant: AUC- and ROC-analysis, logistic regression with feature selection). This approach allowed exploring significant and independent but also redundant MR-parameters; furthermore, overall-accuracy of the protocol could be addressed to stratify the reference-standard.
Results: In univariate analysis FA reached highest accuracy (AUC=0.92). K^{ep} and ADC did not provide additional diagnostic value in multivariate analysis ($P < 0.05$). Yet K^{trans}, V_e and FA were identified as significant and independent predictors of malignant brain tumours (r^2=1; AUC=1).
Conclusion: Multiparametric magnetic resonance imaging enabled accurate quantitative assessment of brain tumours. However, our analysis identified also redundant information without additional diagnostic-value. This approach might help to translate multiparametric imaging parameters into diagnostic information and thus could facilitate its application in clinical practice.

B-0983 14:09

7 Tesla MRI goes clinical: imaging Glioblastoma multiforme at 7T versus 3 T

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Purpose: Aim of this trial was to compare the delineation of glioblastoma multiforme on susceptibility-weighted (SWI) and contrast-enhanced MPRAGE MRI utilising 3 T and 7T MRI.
Methods and Materials: 5 subjects were examined on a 3 T (Magnetom Skyra) and a 7T whole-body MR system (Magnetom 7T) utilising 32-channel head-coils (Siemens Healthcare). Minimum intensity projections (MinIP) of a 3 T SWI sequence (voxel size 0.7x0.8x2.6 mm3) were compared to 7 T SWI MinIPs (voxel size = 0.25x0.25x1.0 mm3). A T 1-w 3D MPRAGE at 3 T (voxel size = 0.5x1.0x1.0 mm3) after the application of Gadobutrol (Bayer Healthcare) was compared to 7 T MPRAGE MRI (voxel size = 0.7 x 0.7 x 0.7 mm3). Two radiologists assessed the delineation of the (1) tumor in T1w MRI, (2) microvasculature in SWI imaging and (3) impairment due to artifacts utilising a 5-point scale (5= excellent to 1= non-diagnostic).
Results: Visual analysis revealed an equivalently excellent delineation of tumor extent and morphology for MPRAGE imaging at both field strengths (MPRAGE 3 T 4.78 vs MPRAGE 7T 4.80). 7T SWI demonstrated its superiority in vessel assessment, yielding a significant improvement in the delineation of tumor-associated microvasculature (SWI 3 T 3.79 vs SWI 7T 4.85). Evaluation of artifacts showed slightly stronger image impairment for 7T imaging (mean3 T 4.79 vs mean7T 4.34).
Conclusion: Both field strengths provide high-quality assessment of tumor extent and morphology, with 7T SWI demonstrating its superiority in the assessment of microvasculature. Hence, an increase of the field strength to 7T may help to better understand tumor-associated neoangionesis.

B-0984 14:18

Histogram analysis of apparent diffusion coefficient map of diffusion-weighted MR imaging in endometrial cancer: a preliminary correlation study with histological grade

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Purpose: To explore the role of histogram analysis of ADC maps based on entire tumour volume in determining the grade of endometrial cancer.
Methods and Materials: This study was IRB-approved with waiver of informed consent. 33 patients with endometrial cancer underwent diffusion-weighted MR imaging (b=0, 600, 1000 s/mm^2), and corresponding ADC maps were acquired. ROIs were drawn on all slices of the ADC map in which the tumour was visualised including areas of necrosis to derive volume-based histographic ADC data. Histogram parameters (5-95th percentiles, mean, standard deviation, skewness, kurtosis) were correlated with histological grade using one-way ANOVA with Tukey-Kramer test for post hoc comparisons, and were compared between high (grade 3) and low (grades 1/2) grade using Student t-test. ROC curve analysis was performed to determine the optimum threshold value for each parameter, and their corresponding sensitivity and specificity.
Results: The standard deviation, quartile, 75th, 90th and 95th percentiles of ADC showed significant differences between grades (P≤0.03 for all) and between high- and low-grades (P≤0.024 for all). There was no significant correlation between tumour grade and other parameter. ROC curve analysis yielded sensitivities/specificities of 75%/96%, 62.5%/92%, 100%/52%, 100%/72%, and 100%/88%, using standard deviation, quartile, 75th, 90th and 95th percentiles for determining high grade with corresponding AUCs of 0.787, 0.792, 0.765, 0.880, and 0.925, respectively.
Conclusion: Histogram analysis of ADC maps based on entire tumour volume can be useful for predicting the histological grade of endometrial cancer. The 90th and 95th percentiles of ADC were the most promising parameters for differentiating high- from low-grade.

B-0985 14:27

Tumour-to-liver ratio is superior to a SUVmax cut-off for detection of malignant peripheral nerve sheath tumours in neurofibromatosis type 1

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Purpose: For evaluation of malignant transformation of peripheral nerve sheath tumours (MPNSTs) in patients with neurofibromatosis Type 1 (NF1), a standard SUV cut-off value is used without accounting for the interindividual variability, leading to a substantial number of false-positive results. The aim of this study was to evaluate the potential usefulness of normalisation of intratumoural tracer uptake in FDG PET/CT to a reference tissue as compared to a cut-off SUV_{max} to reduce false negative results.
Methods and Materials: 49 NF1 patients underwent ^{18}F-FDG PET/CT. Intralesional ^{18}F-FDG uptake was analysed by assessment of the maximum standardised uptake value (SUV). Tracer uptake was normalised to different reference tissues. To assess the diagnostic performance of normalised tracer uptake for detection of malignancy in PNSTs as compared to a standard SUV_{max} cut-off of 3.5, ROC analyses were performed. Histopathology, clinical and radiological follow-up served as reference standards.
Results: Using a SUV_{max} cut-off value of 35 demonstrated a sensitivity of 100% and a specificity of 79.8%. Normalisation of tracer uptake to liver tissue resulted in a significant improvement (p=0.013, McNemar test), demonstrating a specificity of 90.3%, maintaining a sensitivity of 100%. A cut-off value of 2.6 using the tumour-to-liver ratio was the optimum threshold for tumour differentiation (AUC=0.9735).
Conclusion: Quantitative 18 F-FDG PET/CT may identify malignant change in plexiform neurofibromas with high accuracy. Increased accuracy could be obtained by calculating a tumour-to-liver ratio, offering significantly higher specificity than the standard SUV_{max} cut-off. We recommend using a tumour-to-liver ratio cut-off value of 2.6 for detection of malignancy.

B-0986 14:36

Dynamic features of MR-guided histologically proven lesions: comparison 1.5 T vs 3 T MRI

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Purpose: Current study compared dynamic features of only MR-visible lesions at 1.5 T vs 3 T according to histopathology outcome (MR-guided biopsy).
Methods and Materials: 425 MR-guided biopsies were recommended due to diagnostic breast-MRI from 2007 to 2013 at our departement. Dynamic characteristics (initial signal increase; wash out, enhancement-shape, type, blooming, adjacent vessel) were matched to histopathology. 354 and 71 interventions were performed at 1.5 T and 3 T (Philips Achiva and Ingenia). Mean lesion size was 6 and 7 mm, respectively. Diagnostic study protocol was similar.

Results: In 285/354 and in 62/71 cases, biopsy was finished successfully at 1.5 T and 3 T, respectively (19.5% vs. 9.8%). 50.8%/42.2% of recommended biopsies were proven as B2 at 1.5 T/3 T, respectively. Rapid initial peak signal increase occurred in 81.7%/80.0% vs. 88.9%/88.2% at benign/malignant lesions at 1.5 T/3 T. Wash out curve was observed at 61.7%/56.7% of benign lesions and 72.2%/76.5% of malignant lesions at 1.5 T/3 T. Blooming is significantly more common at malignant and premalignant lesions, but also at 3 T vs. 1.5 T: benign: 1.5 T/3 T: 28.9%/66.7%; in situ: 49%/64.7%; invasive malignant: 44.4%/82.3%. Ring enhancement is more common in malignant lesions and slightly more common at 3 T: Benign 1.5 T/3 T: 17.2%/20.0%; in situ: 11.8%/23.5%; malignant: 27.8/29.4%. Adjacent vessel sign is significantly more often visible at 3 T/1.5 T: benign lesions: 76.5%/36.1%; malignant lesions 88.2%/50.0%.
Conclusion: Dynamic features differ dignity dependent suggesting a malignant lesion to be associated with ring enhancement, blooming, adjacent vessel. Sign-occurance dependends on magnetic field-strength. MR-guided biopsies at 3 T are safe, abortion rate is significantly lower and verification of B3b/B5a/B5b is significantly more common at 3 T vs. 1.5 T.

B-0987 14:45

Modification in abdominal fat distribution after aromatase inhibitor in breast cancer patients using CT volumetry

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Purpose: To describe modification of subcutaneous adipose tissue (SAT) and visceral adipose tissue (VAT) distributions in breast cancer patients following therapy with aromatase inhibitors (AI) using CT volumetric measurement of abdominal body fat distribution.
Methods and Materials: 64 consecutive patients (mean age 55.8±11.7 years; age range 36-77) with a history of radical mastectomy, who were receiving adjuvant AI therapy (anastrozolo n=33; letrozolo n=31) were included. Patients were evaluated with CT before and after AI therapy, with imaging follow-up of 4.3±2.2 years. Abdominal fat distribution analysis was automatically calculated using a workstation that obtained total abdominal adipose tissue (TAAT) area (mm^3). SAT was manually segmented and VAT was determined as TAAT-SAT. Percentages were calculated for change of TAAT, VAT and SAT. VAT/SAT ratio was calculated. Student-T-test was used to compare the variables.
Results: Percentage of TAAT after AI therapy: mean increase of 9.1% from ase-line 16280.3±6953.3 mm^3 (average and standard deviation SD) to 17763.6±6850.8 mm^3. Two groups of patients were observed: those with an increase in TAAT (group A, 43 patients), those with a decrease (group B, 21 patients). Modification of VAT/SAT ratio was observed (1.38-1.69) in all subjects, reflecting a relatively increased volume of VAT (mean 18%) and slight mean reduction of SAT (mean 1.9%).
Conclusion: Therapy with AI in breast cancer patients was accompanied with a change in fat distribution to relatively greater VAT/SAT ratio in all the patients, regardless of whether they gained or lost weight after therapy. Since this pattern of fat distribution is associated with the metabolic syndrome, attention must be paid to these clinical manifestations in patients during their follow-up management.

B-0988 14:54

Assessing pathologic response in colorectal liver metastases undergoing preoperative chemotherapy: a comparison of CT texture analysis with RECIST and tumour volumetry

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Purpose: Aim was to compare the potential of CT texture analysis, CT tumour volumetry and unidimensional (RECIST) measurements for response assessment of colorectal liver metastases undergoing preoperative chemotherapy.
Methods and Materials: Twenty-two patients with known colorectal liver metastases who underwent CT both before and after chemotherapy were included. Texture analysis of the total volume of all metastatic lesions was performed on portal phase CT-images. Mean intensity (M), entropy (E) and uniformity (U) were derived without filtration (0.0) and with different filters corresponding to fine (0.5), medium (1.5), and coarse (2.5) textures. Additionally, total tumour volume (mm3) and largest lesion diameter (according to RECIST 1.1) were determined. Pre-, post-chemotherapy and relative change rates (Δ) of the different texture parameters, volume and RECIST-diameters were compared between good responders (n=8, defined as histological tumour regression grade (TRG) of 1-2) and poor responders (n=14; TRG 3-5).
Results: For CT texture analyses, the post-treatment E0.0, U0.0 as well as the ΔE0.0, E0.5, E1.5, U0.5 and U1.5 were significantly different between good and poor responders (p=0.01-0.04). Pre-chemotherapy texture parameters were not significantly different ($p > 0.05$). The Δvolume of good responders was significantly different from poor responders (p=0.048).There were no differences between good and poor responders for mean diameters according to RECIST.
Conclusion: Unidimensional tumour measurements according to RECIST are not helpful to assess pathologic response after treatment. Tumour volumetry and in particular CT texture analyses withhold promise to discriminate between poor and good responders after chemotherapy.

B-0989 15:03

Texture analysis on pre-treatment contrast-enhanced CT of colorectal cancer liver metastases: prediction of response to bevacizumab-containing chemotherapy according to Choi's criteria

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Purpose: To test the correlation between tumour heterogeneity measured on pre-treatment contrast-enhanced CT (CECT) and response to bevacizumab-containing therapy assessed by Choi's criteria in colorectal cancer liver metastases (CRC-LM). Recent studies suggest that response to anti-angiogenetic drugs defined by Choi's criteria better correlates with prognosis than RECIST-based evaluation.
Methods and Materials: Fifty-seven CRC-LM in 25 patients treated with bevacizumab-containing therapy were included. Uniformity (U) of fine texture was quantified for each lesion on pre-treatment CECT (portal phase). Treatment response was assessed by Choi's criteria at lesion-level. Multivariate logistic regression was used to test the predictive value of U and other lesion- and patient-related variables.
Results: 34 CRC-LM responded to therapy (partially or completely), 23 remained stable or progressed. U was significantly lower in responders than in non-responders ($p < 0.0001$). Multivariate analysis (including: U, lesion size, lesion CT density, scheme of bevacizumab-associated chemotherapy, chemotherapy line number) demonstrated that U was the unique predictor of treatment response. Dividing U into tertiles, lesions belonging to 1st tertile had 12-folds (p0.03) and 71-folds (p0.0003) higher probability of response compared to lesions belonging to 2nd and 3rd tertile, respectively. Ninety-five percent, 39% and 21% of lesions belonging respectively to 1st, 2nd and 3rd tertile responded to therapy ($p < 0.0001$, p trend < 0.0001).
Conclusion: Heterogeneity of CRC-LM quantified on CECT correlates with probability of response to bevacizumab-containing therapy, as assessed by Choi's criteria, and could help to stratify patients undergoing chemotherapy.

B-0990 15:12

Texture analysis on pre-treatment contrast-enhanced CT of colorectal cancer liver metastases: prediction of response to bevacizumab-containing chemotherapy according to RECIST 1.1

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Purpose: To test whether texture analysis (TA) on pre-treatment contrast-enhanced CT (CECT) has the potential to predict the response of colorectal cancer liver metastases (CRC-LM) to bevacizumab-containing therapy.
Methods and Materials: Fifty-seven CRC-LM in 25 patients treated with bevacizumab-containing therapy were included. Fine texture of each lesion was extracted and quantified on pre-treatment CECT images (portal phase), resulting in a parameter (uniformity, U) describing tumour heterogeneity. Treatment response was assessed by RECIST1.1 at lesion-level. Interobserver variability of U was measured using Bland-Altman method. The predictive value of U and other lesion- and patient-related variables was tested by multivariate logistic regression.
Results: Twenty-two lesions showed a response (partial/complete); absence of response was observed in 35 lesions. Interobserver variability of U was low. U was significantly lower in responders than in non-responders ($p > 0.0001$). Multivariate analysis (U, lesion size, lesion CT density, bevacizumab-associated chemotherapy scheme, chemotherapy line number) demonstrated that U was the unique predictor of treatment response. Dividing U into tertiles, lesions belonging to 1st tertile had a 13-folds (p0.02) and 39-folds (p0.001) higher probability of response compared to lesions belonging to 2nd and 3rd tertile, respectively. Lesion CT density was close to a marginally significant level (p0.06), suggesting that lesions with higher CECT enhancement tend to better respond to therapy.
Conclusion: Tumour heterogeneity quantified by TA on CECT allowed to predict response to bevacizumab-containing therapy in CRC-LM, according to RECIST1.1.

B-0991 15:21

Texture analysis as a predictive and prognostic biomarker of tumoural response to neoadjuvant chemoradiotherapy in rectal cancer patients studied with 3 T MR

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Purpose: To determine if T2-weighted MR image texture features of rectal cancer can predict tumoral response in patients treated with neoadjuvant chemoradiotherapy.
Methods and Materials: Fifteen consecutive patients underwent pre- and post-treatment (6-8 weeks) MRI performed at 3 T. Treatment protocol consisted of neoadjuvant chemoradiotherapy with oxaliplatin and 5-Fluorouracile. Texture was assessed within unenhanced axial T2-weigthed images by manually delineating a ROI around the tumor outline for the largest cross-sectional area. Heterogeneity within this ROI was quantified using TexRAD, a commercially available research software algorithm that selectively filters and extracts texture at different anatomic scales (features of 2-6 mm radius representing fine to coarse scales) with quantification of kurtosis (pointedness of distribution or histogram) and mean value of positive pixels (MPP). Surgical specimens were the gold standard.
Results: Six patients showed complete pathological response (cPR) and 4 patients partial response (PR). Five patients were classified as non-responders (NR). A significant difference in baseline kurtosis was observed between cPR in comparison with PR+NR (p=.01). After treatment, a significant difference in kurtosis and MPP was observed between cPR and PR+NR (p=.045) and between cPR+PR and NR (p=.041) respectively. Relative change in kurtosis and MPP acted as prognostic biomarkers between cPR and PR+NR (p=0.034 and p=0.045 respectively) in addition to between cPR+PR and NR (MPP, p=0.041).
Conclusion: Texture parameters derived from T2w images of rectal cancer have the potential to act as a predictive and prognostic biomarker of tumoral response to neoadjuvant chemoradiotherapy.

14:00 - 15:30 **Room F2**

Breast

SS 1802

PEM, PET and novel MRI techniques

Moderators:
A. Selim; Cairo/EG
P. Zamecnik; Nijmegen/NL

B-0992 14:00

High specificity and even high sensitivity of positron emission mammography (PEM) in diagnosis of breast cancer

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Purpose: What will cause the diagnostic performance of PEM, a HR-PET with intrinsic resolution of 1.6 mm in detection of breast cancer (B-Ca)?
Methods and Materials: PEM was performed in 122 lesions with suspicious breast lesions 90 min after i.v. application of 3.5 MBq F-18-FDG per KG body weight. A ROI marked the target lesion, measured by the maximum PEM uptake value (PUVmax) and was correlated with a corresponding non-target ROI in the contra lateral healthy breast determining the target/non-target ratio. Two independent readers analysed images of all 122 lesions and compared the results to histopathology (11 PEM-Biopsies/8 Breast-Cancers) later. The group analyses for all malignant, benign, corresponding non-target lesions and the mean target/non-target ratio were calculated by paired Student t-Test.
Results: 22 out of 122 lesions were malignant. Mean of PUVmax was measured 4.3±2.7 in malignant lesions and 1.2±0.4 for the contra-lateral healthy breast (p=0.001). The mean target/non-target ratio in patients with B-Ca of 3.7±1.5 was significantly higher compared to benign lesions 1.2±0.35 (p=0.001). Considering a PUVmax > 1.9, PEM was true-positive in all 22 cancers resulting in a sensitivity of 100%, specificity of 97%, PPV of 88% and NPV of 100%. Detecting of B-Ca by PEM was at it´s best observed with a PUVmax cut-off level of > 1.9 combined with a target/non-target ratio of > 1.4.
Conclusion: PEM detects Breast Cancer with high sensitivity and high specificity. The higher specificity causes a lower rate of biopsies, surgery, chemotherapy and costs, therefore a evidence based study will start in Germany.

B-0993 14:09

Correlation of MIB1 proliferation index with quantitative PET and 3 Tesla MRI-derived imaging biomarkers

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Purpose: In recent years, proliferative markers have been broadly evaluated as prognostic and predictive factors for early stage breast cancer (BC) patients and studies have shown a statistically significant correlation with clinical outcome. In clinical practice, proliferation in BC is often assessed through immunohistochemistry (IHC) measurement of MIB1 expression. This study aimed to determine possible correlations between quantitative biomarkers obtained from PET-CT and 3 T MRI and the MIB1 proliferation index.
Methods and Materials: In this IRB-approved prospective study, 249 patients with primary BC were included. Before undergoing surgery, all patients underwent 3 T-MRI including ADC measurements of BC lesions. Further, Cho-SNR was measured by 1H-MRSI in 62 patients. 134 patients underwent 18 FDG breast PET-CT and maximum standardised uptake value (SUVmax) of tumours was calculated. Cell proliferation of tumours was assessed through standard immunohistochemistry with MIB1. Proliferative activity derived from MIB1 was categorised into: 30 high. Appropriate statistical tests were used to test for any association among SUVmax, ADC, SNR and MIB1.
Results: A significant association between MIB1 of BC and SUVmax was identified ($p < 0.001$). There was a significant difference of SUVmax for tumours with high proliferation compared to medium ($p < 0.001$) and low ($p < 0.001$) proliferation. There was no significant correlation of MIB1 with both ADC (p=0.424) and Cho-SNR (p=0.082).
Conclusion: In primary BC, a correlation of MIB proliferation index was found for the imaging biomarker SUVmax with 18 FDG breast PET-CT, but not for quantitative imaging biomarkers obtained from 3 Tesla MRI.

B-0994 14:18

The role of FUSION between MRI and PET-CT as preoperative staging

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Purpose: The objective of our study was to compare the sensitivity (SE) and specificity (SP) of preoperative MRI, PET-CT and FUSION between both techniques.
Methods and Materials: 31 consecutive patients with histologically proven invasive breast cancer and both preoperative MRI and PET-CT were selected. All the PET-CT studies were performed using the breast MRI coil with the patient in prone position. We retrospectively evaluated the MRI and PET-CT images blinded to the final diagnosis. The FUSION between MRI and PET-CT was performed using the software TRUE-D. The FUSION images were interpreted in agreement between 2 breast radiologists and 2 nuclear medicine doctors. All the lesions were classified as positive (malignant) or negative for each technique and compared with the gold standard (surgery or follow-up). The results were collected using an excel table to calculate the sensitivity and specificity, and the statistical significance was studied using the PEPI software.
Results: 31 patients with 67 lesions were studied. Out of them, 40 lesions were histologically malignant. The SE and SP for each technique were: MRI 97.5% and 11.1%; PET-CT 92.5% and 85.2%; FUSION 95% and 96.3%. The comparison between MRI and FUSION showed statistically significance for SP (11.1% vs 96.3%; $p < 0.05$) but not for SE (97.5% vs 95%; $p > 0.05$). However, the comparison between PET-CT and FUSION showed no statistically differences (SE: 92.5% vs 95%; SP: 85.2% vs 96.3%; $p > 0.05$).
Conclusion: The FUSION between MRI and PET-CT significantly increases the specificity of preoperative MRI without decreasing the sensitivity.

B-0995 14:27

The value of DWI based on biexponential model in differential diagnosis between benign and malignant lesions of breast

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Purpose: To investigate the application value of DWI based on biexponential signal decay modelling with extender b-factor range in differential diagnosis of benign and malignant lesions of breast.
Methods and Materials: A total of 73 patients with breast tumour underwent DWI based on the biexponential signal decay model with extended b-factor range (eight b-factors, were 0, 20, 50, 100, 200, 400, 800, 1200 s/mm^2). Among them, benign lesions were found in 35 cases (41 breast tumour, benign group), while malignant lesions were found in 38 cases (39 breast tumour, malignant group). The value of slow apparent diffusion coefficient, fast apparent diffusion coefficient and fraction of fast ADC of lesions were measured on Advantage Windows 4.5 workstation and these parameters were compared if they had statistically significant differences between the benign and malignant groups.

Results: ADC_{slow}, ADC_{fast} and f_{fast} were (1.24±0.40) $\times 10^{-3}$ mm^2/s, (10.70±8.26) $\times 10^{-3}$ mm^2/s and (15.69±3.88)% in benign group. While they were (0.80±0.14)$\times 10^{-3}$ mm^2/s, (13.79±7.62)$\times 10^{-3}$ mm^2/s and (20.02±5.79)% in malignant groups. The statistically significant differences of ADC_{slow} and f_{fast} were found among the two groups with comparison, while the statistically significant differences of ADC_{fast} were not found among the two groups with comparison.
Conclusion: Biexponential signal decay model of DWI with extended b-factor range can provide significant tissue characterisation parameters for differential diagnosis between benign and malignant lesions of breast.

B-0996 14:36

Peritumoral anisotrophy of the breast cancer on diffusion tensor imaging
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Purpose: Our goal is to demonstrate the anisotropic water diffusion at the periphery of the breast cancer, and to survey the clinical implications.
Methods and Materials: To collect breast cancer cases due to preoperative assessment from March 2010 to July 2013, we have 22 cases who received diffusion tensor imaging (DTI), and 13 cases were proved to be malignant. We analyse their DTI images and correlate with their histopathology, including immunohistochemical (IHC) stains.
Results: Of these 13 malignant cases, there are 1 case with lymphoma, 4 cases with in situ carcinoma, and 8 cases with invasive ductal carcinoma. Peritumoral anisotrophy is only identified in invasive ductal carcinoma (7/8). Parametric DTI (λ1, λ2, λ3, λ1-λ3, FA, MD, ADC) reveals no significant relationship with IHC stains (ER/PR/Her2/Ki67). However, there is relatively significant finding on a Her2 type case, but it does not demonstrate peritumoral anisotropy.
Conclusion: Normal breast tissues (ductal/glandular region) reveal low-to-moderate anisotropy. When a breast tumor develops, it will cause fibroglandular tissue less anisotrophy together with peritumoral anisotropy (mass effect). DTI seems not to predict the prognosis of breast cancer due to no significant relationship with IHC stain.

B-0997 14:45

Clinical utilisation of breast diffusion tensor MRI
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Purpose: To investigate breast diffusion tensor parameters under various hormonal manipulations and to evaluate the ability of these parameters to detect and diagnose breast cancer.
Methods and Materials: All volunteers were scanned at 3 T using DTI and T2-weighted protocols. Patients with breast lesions (n=106) were also scanned using a DCE protocol. Hormonal changes were investigated (n=45) in premenopausal women scanned four-times during menstrual-cycle, in lactating women and in postmenopausal (HRT±) women.
Results: DTI parameters of premenopausal healthy volunteers were highly steady along the menstrual cycle, exhibiting low (1-2 %) within-subject coefficient of variance, and high (0.93-0.98) intra-class correlation. Significantly lower diffusion coefficients were found in the HRT (-) as compared with HRT (+) or premenopausal volunteers, and in lactating volunteers as compared with premenopausal volunteers. All breast lesions were enhanced by DCE but varied in the dynamic features. The DTI parameters: λ1, λ1-λ3 and ADC were significantly lower in the cancers than in normal tissue and benign lesions, enabling high detection sensitivity. In heterogeneously dense and highly dense breasts DTI detection rate was the same as DCE. However, in highly fatty breasts technical challenges due to inhomogeneous fat-suppression, low S/N and EPI distortions impaired DTI utility.
Conclusion: DTI has the potential to serve as a standalone method for detecting breast cancer in patients with moderate to high-dense breasts and when DCE is prohibited. The timing for performing breast DTI is not restricted to a certain phase during menstruation. The modulations in diffusion parameters due to HRT and lactation should be taken into account upon DTI evaluation.

B-0998 14:54

Breast MR spectroscopy at 3 T in biopsy proved breast cancers: does choline peak correlate with prognostic factors?
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Purpose: To evaluate the correlation between the presence of choline peak on MR spectroscopy at 3 T and prognostic factors in patients with biopsy proved breast cancer.
Methods and Materials: Breast MR spectroscopy was performed at 3 T in patients with biopsy proved malignant lesions measuring 8 mm or larger at MR imaging. Single-voxel MR spectroscopy data were collected from a single rectangular volume of interest that encompassed the lesion. MR spectroscopy findings were then compared with histologic findings. Lesion size, histotype, nuclear grade, receptor status (ER, PgR), and Ki67 and HER2 expression were evaluated.
Results: 102 patients with BI-RADS 6 lesions (94/102 IDC; 8/102 ILC) were evaluated. Choline peak was detectable in 48/102 cases, it was not detectable in 54/102. There was a statistically significant association between the choline peak and the lesions size (p=0.005). The choline peak was significantly associated with Ki-67 (median value 24.63 ± 21.37, p=0.003). We observed a statistically significant association between choline peak and grade 3 (24/102 patients, 23.5%, p=0.001) and between choline peak and HER2 (p=0.04). No statistically significant association of choline peak with receptor status (ER, PgR) and Luminal A, B1 and B2 was detected, as well as, between choline peak and triple negative; although 66.66% of triple negative patients with no detectable choline peak, had lesions with a large central area of necrosis.
Conclusion: 3 T breast MR spectroscopy, can be a tool to predict tumour aggressiveness and the correlation between choline peak and prognostic factors such as Ki67, HER2 and grading 3, may have a clinical relevance.

B-0999 15:03

Value of MR-breast elastography as an adjunct tool to MRI to diagnose and characterise breast lesions
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Purpose: To evaluate the value of MR-Breast elastography (MRE) in association with standard breast MRI to improve lesion analysis.
Methods and Materials: An optimised MRE sequence covering entire breast in 10 minutes was developed and applied on 10 healthy volunteers. 50 patients presenting an undetermined or suspicious breast lesion (37 cancers, 13 benign lesions) were also included in this study. All patients were examined with standard breast MRI (T1w and T2w with fat suppression sequences, dynamic 3DFSPGR sequence with and without IV gadolinium chelates injection) and MRE with a dedicated prototype; Morphological, kinetic and visco-elastic MR parameters (Gd, (dynamic modulus: elasticity), Gl (loss modulus, viscosity) and y=Gl/Gd) were correlated to pathology. Specific histological parameters (vascular grading, fibrosis, necrosis) were analysed and correlated to visco-elastic MR parameters.
Results: MR visco-elastic properties were strongly correlated with Bi-RADS malignancy score and with malignant and benign status (p=0.02). Gd value (stiffness) decreased as BI-Rads score increased. Gl parameter (Loss modulus) was higher in malignant lesions in comparison with benign lesions, with viscosity level statistically higher in malignant lesions (p=0.02). Ratio y (Gl/Gd) was significantly higher in malignant lesions (p=0.002). Addition of MRE sequence to standard breast MRI improved significantly breast MRI sensitivity (78 to 91 %) without reduction in specificity. MR viscoelastic parameters were not significantly linked to specific histological parameters.
Conclusion: MRE may be an adjunct new functional tool to better discriminate undetermined or suspicious enhancing lesions on standard breast MRI. Viscoelastic MR properties may be linked to BI-Rads categories.

B-1000 15:12

Magnetic resonance electrical impedance mammography: a new approach to breast cancer imaging
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Purpose: The purpose of this study was to investigate the use of magnetic resonance electrical impedance mammography (MREIM) for breast cancer screening. We have previously shown that breast MRI specificity could improve by combining standard breast MR with a time varying electric field and exploiting conductivity differences between normal and malignant breast tissue.
Methods and Materials: Dedicated phantoms and hardware were developed to fit within the stabilisation paddles of a standard MR breast coil. Electrical conductivity differences between tissue and tumour-like materials were studied. A theoretical model was developed for the conductive properties of the tumour-normal tissue environment within the induced magnetic field. Computer simulations of the perturbed MR acquisition process were then generated and compared to the experimental data.
Results: A detectable differential signal was produced in phantom areas of higher electrical conductivity by the confluence of a frequency encode effect that manifests as a differential signal across the "malignancy" area and a phase encode effect that appears as a differential signal about the "malignancy" border. The signal was generated without gadolinium contrast injection and did not require special image reconstruction. Imaging seems possible with an add-on apparatus "invisible" to the patient without cumbersome electrode configurations. Theory and simulation agreed with the experiment.

Conclusion: Preliminary results suggest that tissue conductivity combined with magnetic imaging properties could be the new biomarker for breast cancer. Current work includes the development of durable and compliant phantoms with stable electrical and mechanical properties to allow optimisation of the MR sequence parameters for this technique.
Author Disclosures:
E. Wollin: Patent Holder; MREIM. Other; President, Wollin Ventures Inc.

B-1001 15:21

Quantitative imaging of breast cancer: association between receptor status, 18 FDG-PET and 3 Tesla MRI using DWI and 3D-MR-spectroscopy
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Purpose: To determine whether correlations exist between imaging biomarkers such as SUVmax with 18 FDG breast PET-CT or ADC with diffusion-weighted imaging and choline (Cho) SNR with 1H-MRSI of primary breast cancer (BC) lesions and IHC-derived receptor status.
Methods and Materials: In this IRB-approved prospective study, 249 patients with primary BC were included. Before surgery, all patients underwent 3 T MRI including DWI with ADC measurements in all patients. Cho-SNR obtained by 3D-1H-MRSI was available in 62 cancers. 134 patients underwent 18 FDG breast PET-CT and SUVmax of tumours was calculated. IHC was performed on a surgical specimen. Appropriate statistical tests were used to test for possible associations among ER, PR, HER2 and imaging biomarkers.
Results: A significant association was found between a triple negative status and the SUVmax ($p < 0.001$) of breast cancer. ER-negative BC (mean SUVmax 9.9) demonstrated a significantly higher SUVmax than did ER-positive BC (median SUV, 5.1) ($p= 0.02$). A statistical significant difference was found for SUVmax of PR-negative vs. PR-positive lesions with a mean SUVmax of 7.7 and 4.9 (p=0.026), respectively. No such associations were found for ADC and Cho measurements (P≥0.556). HER2 receptor status did not correlate with any imaging biomarker (P≥0.252).
Conclusion: Receptor status of BC correlates with SUVmax. ER-negative BC displays higher 18 FDG uptake than ER-positive BC. Triple-negative BC is associated with increased 18 FDG-uptake commensurate with its aggressive biology. No such associations were found for ADC and Cho measurements (P≥0.556). HER2 receptor status did not correlate with any imaging biomarker (P≥0.252).

14:00 - 15:30 **Room G/H**

Genitourinary

SS 1807

New frontiers in GU imaging

Moderators:
B. Brkljacic; Zagreb/HR
M. Notohamiprodjo; Munich/DE

B-1002 14:00

Added value of functional MRI with diffusion-weighted imaging (DWI) and ADC map in characterisation of undetermined adrenal lesions: comparison with chemical shift imaging
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Purpose: To assess the diagnostic performance of diffusion-weighted imaging (DWI) with apparent diffusion coefficient (ADC) value, in the evaluation and characterisation of indeterminate adrenal lesions.
Methods and Materials: From October 2011 to may 2013, a total of 87 patients (36 women, 51 men; mean age 56 years; range 31-85 years) with different benign and malignant adrenal lesions (adenomas, myelolipomas, metastases and primitive carcinomas) were prospectively evaluated on a 1.5 T MRI scan (Achieva, Philips), with a phased array multi-coil, using a conventional study protocol that included also the acquisition of DWI sequences with b-values of 0, 300, 500 and 1000 mm^2/sec. DWI were compared with T1 FFE in- and out of phase. Mean ADC values of adrenal lesions were calculated, manually drawing a region of interest (ROI) along the contours of adrenal lesion on corresponding maps. Then, obtained data were compared and correlated with chemical shift images and statistical analysis was performed.
Results: The diagnosis of adrenal lesions was proved either by follow-up examinations (stability or size increase over a period of time) or through biopsy. All adrenal lesions showed restriction of diffusion and motion of water protons on DWI images. There was no significant difference in ADC values calculated between adenomas (mean value: 1182±87.3 mm^2/sec), myelolipomas (mean value:1245±180.6 mm^2/sec) and primitive tumours (mean value:1164±79.2 mm^2/sec). The adrenal metastases (mean value:910±87.5 mm^2/sec) presented lower ADC value as compared to the other adrenal lesions but not statistically significant difference were achieved ($p> 0.05$).
Conclusion: The DWI and ADC map are not useful to differentiate between benign and malignant adrenal lesions, but may be helpful in detection of small adrenal lesions. The chemical shift imaging technique remains the most useful sequences for characterisation of indeterminate adrenal lesions.

B-1003 14:09

Elastosonography with transvaginal approach in assessing response to MRgFUS treatment of uterine fibroids: preliminary experience
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Purpose: To investigate the effects of Magnetic Resonance guided Focused Ultrasound (MRgFUS) treatment on fibroids as found at multiparametric ultrasound (US) and real-time elastography (RTE) with transvaginal (TV) approach in symptomatic patients.
Methods and Materials: Ten women (mean age 34) with 10 uterine fibroids were treated with MRgFUS using ExAblate 2100 device (FDA treatment guidelines). All patients performed TV-US before (time0) and after (time1) MRgFUS within the same day. Follow-up TV-US was performed after 3 months (time2). All patients performed CE-MRI following the same schedule. The following features at time0, 1 and 2 were analysed: maximum diameter, color doppler, elastosonography and strain ratio (SR) between fibroids and normal myometrium.
Results: Four/10 patients had a good response (> 80%), 6/10 partial response (< 50%) in terms of NPV (non-perfused volume) as assessed at post treatment CE-MRI. Comparing US-parameters as assessed at time0 vs time1, and 2 we found: decrease in color doppler signals in most of the patients (8/10); no significant difference in maximum diameter comparing time0 to time1 and 2. RTE TV-US showed a significant decrease in SR in 2/10 patients at time1 follow-up, while 3/10 had an increase in SR and in 5/10 there were no difference. At time2 follow-up, as compared to time0, 8/10 patients had a decrease of mean SR after treatment.
Conclusion: Elastosonography is a new diagnostic tool usefull for characterise fibroids for MRgFUS and can be usefull to assess the efficiency of treatment. Further data are needed to confirm our preliminary findings.

B-1004 14:18

Assessment of delayed renal allograft function by arterial spin-labelled magnetic resonance imaging: comparison with kidney biopsy
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Purpose: Delayed renal allograft function (DGF) is defined as failure of serum creatinine to decrease or need for dialysis during the first week after transplantation. DGF is associated with an increased risk of graft loss and acute rejection. We investigate whether arterial spin labelling (ASL) allows detection of DGF.
Methods and Materials: Fourty patients were examined 4-10 days after kidney transplantation using a 1.5-T magnet. Flow alternating inversion recovery (FAIR) trueFISP ASL-sequences were acquired and parameter maps of renal perfusion were calculated. DGF was diagnosed by a nephrologist. Renal biopsy was available in 16/40 patients. Statistical analysis comprised unpaired t-tests, ANOVA and correlation analysis. Perfusion values were adjusted for recipient age, gender and the day of MRI.
Results: DGF was diagnosed in 19/40 patients, 42% of them had an acute rejection at histology. Patients with DGF were significantly older, donor serum creatinine was higher and cold ischaemia time was longer. Renal perfusion in DGF-patients was significantly reduced to 218±18 ml/(min*100 g) compared to patients with normal initial graft function (324±18 ml/(min*100 g); $p < 0.001$). In the subgroup of DGF-patients with acute rejection, renal perfusion was even lower (180±24 ml/(min*100 g)) compared to the subgroup of DGF-patients without rejection ($p < 0.05$) and to patients with normal graft function ($p < 0.001$). Renal perfusion correlated with eGFR at the day of MRI and after 3-months (r=0.69 and r=0.55, respectively).
Conclusion: Non-invasive renal perfusion measurement by ASL allows detection of DGF and renal perfusion significantly correlates with allograft function. Thus, ASL-MRI may improve diagnosis of patients early after kidney transplantation.

B-1005 14:27

Functional evaluation of the kidneys in renal artery stenosis using diffusion tensor imaging

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Purpose: To evaluate the capability of the diffusion tensor imaging (DTI) to detect parenchymal involvement in renal artery stenosis (RAS) by measuring apparent diffusion coefficient (ADC) and fractional anisotropy (FA).
Methods and Materials: Seventeen patients with RAS (10 men; mean age 52.3 years) and 15 patients (9 men; mean age 37.7 years) who did not have kidney diseases, were studied with a 1.5 T MRI scanner. RAS was detected using contrast-enhanced magnetic resonance angiography (CE-MRA). In all cases, DTI sequence was added to the routine MRI protocol. Cortical and medullary regions of interest (ROI) were placed to obtain the corresponding ADC/FA values. Normal kidneys constituted the control group and kidneys with haemodynamic RAS (> 50%) constituted the study group. Student's *t* test was used to compare the mean values of ADC and FA, for each ROI site, between the two groups.
Results: Mean values of ADC and FA in the control group were: $2.53\pm0.16\times10^{-3}$ mm^2/s for cortical ADC, $2.21\pm0.18\times10^{-3}$ mm^2/s for medullary ADC, 0.31±0.062 for cortical FA and 0.39±0.055 for medullary FA. There was no significant difference between the two kidneys. By using CE-MRA, haemodynamic RAS was detected in 14 patients, bilateral in 2: overall, 16 kidneys constituted the study group. The comparison between the two groups showed that medullary ADC and FA in the study group were significantly lower than in the control group (*P*=0.034 and 0.022, respectively); there was no significant difference for the other parameters.
Conclusion: The DTI could be a useful tool in evaluating renal alteration in haemodynamic RAS.
Author Disclosures:
V. Clementi: Employee; General Electric Medical Systems.

B-1006 14:36

Mapping of T1 relaxation time for assessment of renal pathology following ischaemia-induced acute kidney injury in mice

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Purpose: Acute kidney injury (AKI) leads to inflammation, tubular necrosis and renal insufficiency. The purpose was to investigate whether T1-mapping allows evaluation of renal pathology in a mouse model of ischaemia-induced AKI.
Methods and Materials: AKI was induced in C57Bl/6-mice by transient clamping of the right renal pedicle for 35 min (n=10, moderate AKI) or 45 min (n=7, severe AKI). MRI was performed before surgery and at five time points thereafter (d1-d28) using a 7-Tesla magnet. T1-maps were calculated from a fat-saturated echoplanar inversion recovery sequence, and mean T1-values of renal cortex, outer and inner medulla were determined. Kidney volume and the degree of tubular injury at histology were assessed in all animals after the last MRI. Statistical analysis comprised unpaired t-tests, ANOVA, correlation and ROC-curve analysis.
Results: Following AKI, a significant T1-increase, indicating tissue oedema, occurred in all anatomical layers at d7 with highest values in the outer medulla. Compared to pre-surgery values, T1-values after severe AKI were significantly higher (138±2%) than after moderate (121±3%, p=0.001), and T1-increase persisted until d28 (123±4%, $p < 0.05$). Already at d7, T1-values in the outer medulla negatively correlated with relative kidney volume and positively with the degree of tubular injury four weeks after AKI (r=-0.93 and r=0.87, respectively). ROC-curve analysis revealed that T1-increase > 1525 ms at d7 predicts significant tubular injury > 5% after four weeks with sensitivity and specificity of 100% (AUC=1).
Conclusion: T1-mapping allows non-invasive detection of renal damage after AKI in mice and predicts further outcome by assessment of tissue oedema and structural abnormalities.

B-1007 14:45

3 T Diffusion tensor imaging (DTI) in the evaluation of periprostatic nerve bundle before and after radiation therapy

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Purpose: To assess the use of diffusion tensor imaging (DTI) at 3 T for evaluating the periprostatic nerve bundle in terms of neuroanatomical distribution, density and relationship with the capsule before and after radiation therapy (RT).
Methods and Materials: 63 patients with unresectable prostate cancer were enrolled. All underwent a prostate Multiparametric-MRI examination at 3 T magnet (Discovery M750, GE) equipped with an endorectal and a surface coil, before and after 2 months of radiation treatment (35 cycles). Scan protocol included: a morphological study obtained with TSE high-resolution T2-weighted sequences on multiple plans, a dynamic study with contrast medium for lesion localisation, a diffusion study (DWI) with different b values (500.1000,3000) and DTI technique (fibre tracking) using a b value of 1000 with 16 directions.
Results: In all cases before RT it has been possible to display the periprostatic nerve bundle in terms of anatomical distribution, density and distance of the nerve fibres from the capsule; after RT we observed a findings' superposition in 27 patients, partial fibres integrity in 31 patients (fibre loss ranging from 19% to 35%) and massive rarefaction in 5 patients (fibre loss ranging from 42% to 59%). These results compared with IIEF-5 test showed a statistically significative correlation ($p < 0.05$).
Conclusion: DTI technique allows a complete visualisation of periprostatic nerve bundle and plays an important role in evaluating damaged fibres in patients who underwent RT.

B-1008 14:54

Diffusion tensor imaging of the kidney with optimisation of the b value: the initial clinical experience

Q. Feng[1], Z. Ma[1], J. Wu[2]; [1]*Tianjin/CN*, [2]*Dalian/CN (fengqiang1975@163.com)*

Purpose: To evaluate the fractional anisotropy (FA), apparent diffusion coefficient (ADC), signal-to-noise ratio, contrast-to-noise ratio, ADC maps of MR protocols with different b values and obtain the optimal b value of renal diffusion tensor imaging (DTI) at 1.5 T.
Methods and Materials: Twenty healthy volunteers with a mean age of 30±6 years were examined with a respiratory-triggered echo-planar DTI sequence of the kidneys at 1.5 T (TR1400 ms; TE, 74-82 ms; 10 slices; slice thickness, 6 mm with no intersection gap; number of signals acquired, 4; diffusion weightings b=0 and 200, 400, 600, 800, 1000 s/mm^2; 6 diffusion directions). The regions of interests were placed in the cortex and medulla on the ADC map using DTI task card software. The FA value, ADC value and signal intensity were determined and SNR was calculated with the difference-image method. Statistical analysis was performed using one-way ANOVA.
Results: The ADC values of renal parenchyma, cortex and medulla decreased at higher b values, similar to the SNR of renal parenchyma, while the FA values and CNR remained constant at different b values. The ADC values of the cortex were significantly higher than those of the medulla, whereas the FA values of the cortex were lower than those of the medulla. Image quality of the ADC map decreased at higher b values, and b values (0 and 400, 600, 800 s/mm^2, respectively) can be applied to evaluate renal DTI.
Conclusion: Renal DTI (with a b value of 0, 600s /mm^2) was appropriate with good cortex-medulla discrimination.

B-1009 15:03

Multiparametric MRI and state-of-the-art US techniques for the characterisation of prostate cancer in the setting of MR-US fusion biopsy

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Purpose: To investigate whether multiparametric magnetic resonance imaging (MRI) allows lesion localisation in prostate cancer in patients scheduled for MR/US fusion biopsy and whether the findings correlate with state-of-the-art ultrasound in terms of lesion characterisation and guidance of needle placement.
Methods and Materials: Fifty consecutive patients with elevated PSA levels and a history of at least one negative TRUS-guided biopsy underwent multiparametric 3 T MRI without an endorectal coil. MR Datasets (T2w, DWI) were uploaded into a state-of-the-art ultrasound system (Aplio 500, Toshiba), and images were fused in real-time mode during biopsy. Prostate lesions were classified on the basis of MRI (T2w+DWI) and US (B-mode scan, power Doppler, elastography/TDI, CEUS) using a 4-point semiquantitative analogue scale (not suspicious, 0 - highly suspicious, 3). The maximum sum score was 15. Targeted biopsies were performed in the MR/US fusion mode followed by a standard TRUS-guided biopsy.
Results: The detection rate was 40% in the fusion biopsy group versus 22% in the standard TRUS group ($p < 0.01$). PSA levels were significantly higher in patients with prostate cancer. The sum score was higher in the targeted biopsy group with prostate cancer compared to those whose biopsy was negative (11.6±2.7 versus 6.3±2.4; $p < 0.05$). The result correlates with the Gleason score, which increased with the sum score.
Conclusion: Real-time MR/US image fusion may enhance cancer detection rates of TRUS-guided biopsies and contributes to lesion characterisation by state-of-the-art US techniques.

B-1010 15:12

Quantitative Shear Wave ultrasound elastography and multi parametric MR imaging performance for prostate cancer detection as a function of size and Gleason score

J.-M. Correas, A. Khairoune, A.-M. Tissier, G. Khoury, O. Hélénon; *Paris/FR (jean-michel.correas@nck.aphp.fr)*

Purpose: To prospectively evaluate Shear Wave Elastography (SWE) and multi-parametric MRI (mpMRI) diagnostic performance for prostate cancer (PCa) detection and characterisation.
Methods and Materials: 66 men underwent mpMRI (1.5 T, MR-Discovery, GE, USA) and a transrectal SWE examination (AixPlorer, SuperSonic Imagine, France).Two experienced radiologists independently analysed prostate sextant stiffness and mpMRI. Biopsy core pathology (Gleason Score (GS) and PCa size) of corresponding prostate sextants constituted the reference method. The diagnostic performance (sensitivity (Se), specificity (Spe), positive predictive value (PPV), negative predictive value (NPV)) at the sextant level was calculated for SWE and mpMRI considering two PCa populations; PCa1: size≥3 mm and GS≥6; PCa2: size≥9 mm and GS≥7. For mpMRI, two scenari were considered; for mpMRI1 the test was considered positive in the sextant if at least one of T2, Diffusion, and DCE imaging was positive. For mpMRI2, at least two sequences of the three were positive.
Results: A total of 748 sextants was analysed. 99 PCa foci were detected in 32 patients for PCa1 patient population, while for PCa2 36 foci were detected in 16 patients. The different imaging technique performance are summarised below (cutoff value of 35 kPa for SWE): PCa1: Se Spe PPV NPV, mpMRI1 44% 89% 50% 91%, mpMRI2 37% 93% 45% 91%, SWE 87% 86% 50% 98%, PCa2: mpMRI1 72% 87% 33% 98%, mpMRI2 58% 91% 26% 98%, SWE 86% 98% 18% 99%.
Conclusion: mpMRI exhibited good performance for larger and aggressive PCa while SWE provided good diagnostic performance for all PCas.
Author Disclosures:
J.-M. Correas: Speaker; Philips Healthcare, Toshiba Medical System, SuperSonic Imagine, Bracco.

14:00 - 15:30 **Room I/K**

Neuro

SS 1811b

Neuroinflammation and infectious diseases

Moderators:
E.L. Gasparetto; Rio de Janeiro/BR
K.-O. Løvblad; Geneva/CH

B-1012 14:00

Improved differentiation between MS and vascular brain lesions using FLAIR* at 7 Tesla

I.D. Kilsdonk[1], M.P. Wattjes[1], J.P.A. Kuijer[1], M.C. de Jong[1], M.M.A. Conijn[1], P.R. Luijten[2], J.J.G. Geurts[1], M.I. Geerlings[2], F. Barkhof[1]; [1]*Amsterdam/NL*, [2]*Utrecht/NL (i.kilsdonk@vumc.nl)*

Purpose: Common question in daily radiology practice is the challenging differentiation between multiple sclerosis (MS) lesions and white matter (WM) lesions of vascular origin. We aimed to investigate the performance of a new magnetic resonance (MR) image contrast called FLAIR*, at differentiating between MS and vascular brain lesions, at 7 Tesla (T).
Methods and Materials: We examined 16 MS patients (10 female, mean age 50.4 years) and 16 age-matched patients with (risk factors for) vascular disease (6 female, mean age 50.9 years). 3D-FLAIR and 3D T2*-weighted images were combined to generate FLAIR* images. Lesiontype and intensity, perivascular orientation and presence of a hypointense rim were analysed. Differences between patientgroups regarding lesion distribution and perivascular orientation were tested with Fisher's exact test. In addition, sensitivity and specificity of 7T FLAIR* were calculated.
Results: In total, 433 lesions were detected in MS patients versus 86 lesions in vascular patients. Lesions in MS patients were significantly more often oriented in a perivascular manner: 74% vs. 47% ($P < 0.001$). 8 MS lesions (2.3%) were encircled by a hypointense rim, and 28 MS lesions (5.5%) were hypointense on T2*. No vascular lesions showed any rim or hypointensity. Specificity of differentiating MS from vascular lesions on 7T FLAIR* increased when presence of a central vessel is taken into account (from 63% to 81%), most obviously for deep white matter lesions (from 69% to 94%).
Conclusion: 7T FLAIR* improves differentiation between MS lesions and vascular brain lesions based on lesion type, perivascular orientation and distinct morphological characteristics.

Author Disclosures:
I.D. Kilsdonk: Grant Recipient; Dutch MS Research Foundation (grant. no 11-769), Noaber Foundation. **M.P. Wattjes:** Consultant; Biogen Idec. Speaker; Biogen Idec, Bayer Healthcare, Roche, Janssen Cilag. **J.J.G. Geurts:** Advisory Board; Dutch MS Research Foundation, MS Academics, MerckSerono. Board Member; MS International, BMC Neurology. Consultant; MerckSerono, Biogen Idec, TEVA. **F. Barkhof:** Board Member; Brain, European Radiology, Radiology, Multiple Sclerosis, Neuroradiology. Consultant; Bayer-Schering Pharma, Sanofi-Aventis, Biogen-Idec, TEVA, MerckSerono, Novartis, Roche, Synthon BV, Janssen Research. Grant Recipient; Dutch MS Society (EU-FP7). Speaker; Serono Symposia Foundation.

B-1013 14:09

The clinical subtype of multiple sclerosis determines the timeline of temporal lobe atrophy - a voxel based morphometry study

L.R. Kozák, A. Iljicsov, M. Simó, B. Dániel, G. Rudas, P. Barsi; *Budapest/HU (lkozak@mrkk.sote.hu)*

Purpose: Temporal lobe atrophy is associated with the development of disability and cognitive decline in multiple sclerosis (MS). We investigated whether and how temporal gray matter (GM) volume loss depends on the clinical course of MS.
Methods and Materials: We retrospectively analysed 3 T-acquired contrast-enhanced T1-weighted images of 46 patients (32 females, mean age: 36.2±8.7 yrs, mean disease duration: 57.6±50.3 months, mean expanded disability status scale (EDSS): 1.5±1.8); 7 patients had clinically isolated syndrome (CIS), 19 relapsing-remitting (RR), 9 clinically benign RR (RR-B), 7 primary progressive (PP), and 5 secondary progressive (SP) disease course. Voxel based morphometry was performed using the VBM8 toolbox of SPM8 package. Between-group differences were assessed using one-way ANOVAs modeling interactions with EDSS and disease duration, respectively. Age and gender served as nuisance variables in all models. Statistical parametric maps were thresholded at $p < 0.001$ uncorrected, with a cluster-size threshold of 72 voxels.
Results: EDSS-score and disease duration had very similar strong and significant positive correlation across groups ($r=0.52$, $p < 0.0001$), thus for brevity we only report the latter, below. The GM volume and disease duration relationship was significantly different in the temporal lobes, insular cortices, and superior temporal gyri bilaterally, and in the left temporal pole and right anterior cingulate cortex. The middle temporal and insular cortices of the PP and the superior temporal gyri of the RR, RR-B and SP groups showed the most prominent deterioration.
Conclusion: There is differential involvement of the temporal lobes, insulae and other areas depending on the clinical course of MS.

B-1014 14:18

Association of MR findings and serum bilirubin and uric acid levels changes during neuroinflammation in patients with initial and relapsed demyelisation attacks

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Purpose: To examine the endogenous antioxidants values in the earliest phase of demyelisation, we have determined bilirubin and uric acid (UA) serum values in the patients with clinically isolated syndrome (CIS) and relapsing remitting multiple sclerosis (RRMS), regarding their clinical disability, measured by Extended Disability Status Scale (EDSS) and magnetic resonance imaging (MRI) disease activity.
Methods and Materials: The cross-sectional study included 50 CIS patients, aged 17-57 years, 57 RRMS patients, aged 23-58 years, and 20 control patients, aged 23-45 years with non-specific neurological symptoms. All CIS and RRMS patient's clinical presentations were assessed using EDSS. The number of T2W hyperintense lesions and the lesion load of Gd-enhancing lesions on T1W images were calculated. The lesion loads were calculated to volumes. Serum total bilirubin, direct bilirubin and indirect bilirubin concentration as well as UA serum values were measured.
Results: Obtained values of bilirubin and UA were higher in patients with lower MRI lesion number, lower EDSS, and shorter disease duration ($p < 0.05$). The results suggest negative linear correlation between bilirubin and UA levels and MRI findings, disease duration, and EDSS in CIS ($p < 0.01$), with the same correlation between bilirubin and UA levels and disease duration in RRMS patients ($p < 0.01$). There was also significant correlation between bilirubin level and MRI findings and UA levels and EDSS in RRMS patients ($p < 0.01$).
Conclusion: There is a negative linear correlation between bilirubin and UA levels and MRI findings in CIS as well as significant correlation between bilirubin level and MRI findings in RRMS patients.

B-1015 14:27

Longitudinal DTI changes in multiple sclerosis patients with different cortical reorganisation patterns

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Purpose: To investigate longitudinal changes of diffusion-tensor imaging (DTI) data in relapsing-remitting multiple sclerosis (RRMS) patients with different cortical reorganisation patterns.
Methods and Materials: 25 patients with RRMS (7 men), all right-handed, aged 19-50, underwent MRI (Avanto1.5 T, Siemens) during relapse with unilateral light hand palsy, in three and twelve (20 of 25 patients) months after it. Scanning protocol included functional MRI (fMRI) and DTI sequences. FMRI was performed using simple movement paradigm for both hands. DTI data were assessed in regions of interest:corticospinal tract (CST) - pons, peduncles and internal capsules (IC) level; splenium (SCC) and motor area of corpus callosum (MACC).
Results: Differently directed changes of primary sensorimotor cortex (SMC) functional activity during relapse allowed us to divide all patients into two groups: the first one with decrease of SMC activation on palsy-corresponding side in comparison with opposite one (volume ratio (VR) range 0.22-0.79) and the second one with the increase (VR range 1.17-6.19). During relapse these groups differed by DTI indices in CST on the pons level, the first one also had asymmetrical decrease of deep sensitivity on palsy hand (Mann-Whitney U test, $p < 0.05$). In the follow-up, the first group was characterised by DTI changes in palsy-corresponding medial lemniscus, CST on IC level and SCC, the second group - in palsy-corresponding CST on pons and peduncles level and in MACC (repeated measures ANOVA; Newman-Keuls post-hoc test, $p < 0.05$).
Conclusion: RRMS relapse with similar palsy but different sensitivity impairment is characterised by contrary cortical reorganisation patterns, which are associated with different specific longitudinal structural changes, probably due to initially different pathologic mechanisms.

B-1016 14:36

Update on CNS complications after allogeneic bone marrow transplant

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Purpose: 1. To stand out the importance to know the different states of immunosuppresion after a bone marrow transplant (BMT), in order to establish a proper clinical-radiological correlation. 2. To review the main neuroimaging findings of CNS complications observed after BMT.
Methods and Materials: We review the neurological complications in 935 patients who had received an allogeneic bone marrow transplantion at our hospital in the past 12 years. We analysed the neuroimaging findings (CT and MRI) of forty-three patients with neurologic complications and their clinical and autopsy correlation.
Results: The main neurologic CNS complications observed were: a) infections: including viral (12 patients: EBV, CMV, HHV6), bacterial caused by *Pneumococcus* in 3 cases, *Toxoplasmosis* in 2 cases, fungal (2 patients with *Aspergillus, Scedosporium*); b) neoplasm recurrence (9 patients); c) toxic (3 patients); d) vascular complications in 6 patients including subarachnoid haemorrhage, ischaemic strokes and TTP.
Conclusion: Over the last few years, there has been a significant decrease in mortality and complications of BMT. It is essential to carry out a successful clinical-radiological correlation to make a proper diagnostic orientation. Viral infections are one of the biggest diagnostic challenges because MRI findings are often subtle alterations and quite different from the usual lesions described in immunocompentent patients.

B-1017 14:45

Evaluation of brain vascularity and perfusion in TB meningitis using MRA/MR perfusion imaging

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Purpose: Cerebral vasculitis is one of the complications of tuberculous meningitis (TBM). Cerebral infarctions in TBM commonly affect the basal ganglia, thalamus and the internal capsule.The aim of this study is to evaluate the imaging features, vasculitic changes and perfusion of the infarcted brain regions in TBM comparing with the contralateral normal region/healthy subjects.
Methods and Materials: A prospective study of newly diagnosed TBM patients was undertaken between March 2012-September 2013. Standard 3 T brain MRI sequences (T1W, T2W, Flair, DWI, GRE), TOF MRA) and MR Perfusion (Dynamic susceptibility contrast enhanced MR perfusion) were performed at the time of diagnosis.
Results: A total of 8 patients were enrolled. Leptomeningeal and basal cisterns enhancement and tuberculomas were demonstrated in all patients. cerebral infarctions were demonstrated in 6 patients, with similar occurrence of infarction in what has been described as 'TB zone', referring to the heads of the caudate nuclei, anteromedial thalami and internal capsules.All patients demonstrated vasculitis in the anterior or posterior circulations.All patients demonstrated vasculitis in the anterior circulations mainly involving the M1, M2 and A1 segments. Vasculitis in the anterior and posterior circulations was observed in 3 patients. Acute obstructive hydrocephalus was present in 6 patients. MR perfusion study in 4 patients with acute infarctions showed significantly low rCBV and rCBF and increased MTT.
Conclusion: Vascular abnormality mainly affected the middle cerebral, anterior cerebral and supraclinoid internal carotid arteries. Area of acute infarctions shows significant reduction in rCBV and rCBF with prolonged MTT compared to the contralateral normal regions.
Author Disclosures:
K. Rahmat: Grant Recipient; RG390/09H™. **F. Abu-Bakar:** Grant Recipient; RG390/09H™. **N. Ramli:** Grant Recipient; RG390/09H™.

B-1018 14:54

Diffusion-weighted tractography to reconstruct the optic radiation in support of temporal lobe epilepsy surgery

S.P.L. Meesters[1], P.P.W. Ossenblok[2], B.M. ter Haar Romeny[1], O. Schijns[3], L. Wagner[2], P. Hofman[2], A. Vilanova[1]; [1]*Eindhoven/NL*, [2]*Heeze/NL*, [3]*Maastricht/NL*

Purpose: Surgical resection of drug-resistant temporal lobe epilepsy (TLE) leads most pf the candidates to seizure relief. However, disruption of the optic radiation (OR) leads to a visual field deficit (VFD). Diffusion-weighted tractography was applied to reconstruct the OR and pre-operatively predict the VFD. Methodological improvements were made to provide the most reliable reconstruction and its plausibility was evaluated.
Methods and Materials: Diffusion tensor imaging (DTI) is of limited use due to its inability to resolve crossing fibers. Constrained spherical deconvolution (CSD) can describe multiple orientations from the fiber orientation density function. To correct for echo-planar imaging (EPI) distortions, an unwarping method using two-phase encoding directions was evaluated against the fieldmap method for healthy volunteers (n=4). The post-operative damage to the OR in relation to the resection area was compared to pre-operative reconstructions for TLE surgery candidates (n=3).
Results: Reconstructions of the OR with CSD were better described by the underlying diffusion data. The estimated EPI distortions using the two-phase encoding direction method showed a shift of distance of the temporal pole to the anterior extent of the OR in the order of 1 cm. Pre- to post-operative comparisons indicated a good correlation between expected and observed damage to fibers. The presented results are visualised using a 3D smart image.
Conclusion: Significant shifts due to distortions were observed, demonstrating the importance of correction. In the absence of a ground truth, pre- to post-operative comparison allows validation of the reconstruction of the OR, useful for preoperative prediction of VFD.

B-1019 15:03

Comparative evaluation of fungal and pyogenic brain abscesses with susceptibility-weighted imaging

R. Antulov[1], K. Dolic[2], J. Fruehwald-Pallamar[3], D. Miletic[1], M.M. Thurnher[3]; [1]*Rijeka/HR*, [2]*Split/HR*, [3]*Vienna/AT (ronald.antulov@ri.htnet.hr)*

Purpose: Conventional MRI techniques are inadequate to determine the causative agent of brain abscesses. We investigated the value of susceptibility-weighted imaging (SWI) in the differentiation of fungal and pyogenic brain abscesses and the effect of field strength (1.5 T versus 3 T) in SWI for the detection of specific imaging characteristics of brain abscesses.
Methods and Materials: MRI studies of 10 patients with pyogenic and 6 patients with fungal brain abscesses were reviewed. Ten patients underwent examinations on a 3 T scanner and six patients on a 1.5 T scanner. Imaging characteristics on conventional MRI, diffusion-weighted imaging (DWI) and SWI were recorded in all abscesses. All lesions were assessed for the presence of a "dual-rim sign" on SWI.
Results: Homogeneous hyperintensity on DWI was present in 88% of pyogenic abscesses, but in only 7.1% of fungal abscesses. On SWI, 94% of pyogenic abscesses had a complete low signal intensity rim, while 17.9% fungal abscesses showed a complete low signal rim. On a 3 T scanner, the "dual-rim sign" was apparent in all pyogenic abscesses. None of the pyogenic abscesses or any of the fungal abscesses were positive for a "dual-rim sign" on a 1.5 T scanner.
Conclusion: In fungal abscesses, the "dual-rim sign" is not present, but rather, a prominent peripheral rim or marked central susceptibility effects will be seen. The appearance of pyogenic abscesses on SWI depends on the field strength, with the "dual-rim sign" a specific feature of pyogenic brain abscesses on a 3 T scanner.

B-1020 15:12

Brain involvement in patients with inflammatory bowel disease: a voxel-based morphometry and diffusion tensor imaging study

A. Zikou, M. Kosmidou, L. Astrakas, L. Tzarouchi, E. Tsianos, M.I. Argyropoulou; *Ioannina/GR (anzikou@cc.uoi.gr)*

Purpose: Investigation of structural brain changes associated with inflammatory bowel disease (IBD) by assessing the presence of white-matter hyperintensities (WMHIs) and applying voxel-based morphometry (VBM) and tract-based spatial statistics (TBSS) methods.
Methods and Materials: Brain magnetic resonance imaging (MRI) was performed on 18 patients with IBD aged 45.16 ± 14.71 years and 20 aged-matched control subjects. The imaging protocol consisted of a sagittal fluid-attenuation-inversion-recovery (FLAIR), a T1-weighted high-resolution 3-dimensional spoiled gradient-echo sequence, and a multisection spin-echo planar diffusion-weighted sequence. Differences between patients and control subjects in brain volume and diffusion indices were evaluated using the VBM and TBSS methods, respectively. The presence of WMHIs was evaluated on a sagittal FLAIR sequence.
Results: VBM revealed decreased grey matter (GM) volume in patients with IBD in the fusiform and the inferior temporal gyrus bilaterally, the right precentral gyrus, the right supplementary motor area, the right middle frontal gyrus and the left superior parietal gyrus ($p < 0.05$), but no significant difference was observed in white matter (WM) volume. TBSS showed decreased axial diffusivity (AD) in the right corticospinal tract and the right superior longitudinal fasciculus in the patients with IBD compared to the control subjects, and a larger number of WMHIs was observed in the patients ($p < 0.05$).
Conclusion: Patients with IBD show an increase in WMHIs and GM atrophy, probably related to cerebral vasculitis and ischemia. Decreased AD in their major WM tracts could be a secondary phenomenon, representing Wallerian degeneration.

B-1021 15:21

Preserved white matter integrity is a marker of familial longevity

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Purpose: Brain tissue integrity is highly heritable. Its decline is a common ageing phenomenon. This study aimed to determine whether the phenotype of familial longevity is marked by a relative preservation of brain tissue microstructure.
Methods and Materials: Participants came from the Leiden Longevity Study. In total, 185 elderly offspring of nonagenarian siblings, who are enriched for familial factors of longevity, were contrasted with 171 environmentally and age-matched controls. All subjects underwent 3 T whole brain MR diffusion tensor imaging.
Results: Voxel-wise analysis revealed widespread age-related decrease of white matter fractional anisotropy and increase of axial, radial and mean diffusivity (all $p < 0.003$). Offspring showed higher mean white matter fractional anisotropy (Mean (SE): offspring: 0.3232 (0.0009); controls: 0.3212 (0.0009), $p = 0.04$) compared to control subjects independent of cardiovascular risk factors. When differences in white matter diffusion parameters between offspring and control subjects were assessed voxel-wise, offspring showed higher white matter fractional anisotropy and lower white matter radial diffusivity predominantly in the callosal genu and body (both $p < 0.003$). Taking the effect of chronological age on white matter microstructure into account, offspring can be considered 4.5 years "biologically younger" compared to control subjects concerning white matter integrity.
Conclusion: Both elderly offspring of nonagenarian siblings and control subjects show common age-related decline of white matter integrity, which is less marked in the callosal genu and body among the offspring, corresponding to a biological age benefit of 4.5 years.
Author Disclosures:
A. de Craen: Grant Recipient; Grant. **P. Slagboom:** Grant Recipient; Grant.

14:00 - 15:30 **Room L/M**

Physics in Radiology

SS 1813

Advances in digital x-ray imaging

Moderators:
H. Bosmans; Leuven/BE
S.J. Foley; Dublin/IE

B-1022 14:00

Digital subtraction angiography: can we reduce the dose maintaining enough image quality?

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Purpose: Suggest a practical method for dose optimisation in digital subtraction angiography using three different kinds of phantoms.
Methods and Materials: Series of images using digital subtraction angiography were obtained in two different angiography systems for two different patient thicknesses simulated by PMMA plates. Three commercially available phantoms (following IEC/German, British and NEMA standards) were used to assess the features of digital subtraction: mask creation and logarithmic subtraction, dynamic range and contrast sensitivity. In addition, image quality was quantified using measurements of signal-difference-to-noise ratio (SDNR). Phantom entrance dose was measured with both an ionisation chamber and a solid-state detector.
Results: Available phantoms can be used for quality control of the digital subtraction and simultaneously for the quantification of image quality and consequent dose optimisation. For the IEC-DIN phantom, visibility of 5 mg Iodine per ml of contrast at a vascular diameter of 1 mm within homogeneous background was identified with SDNR > 0.20 for a phantom entrance air kerma of 0.43 mGy/image. Equivalent thresholds were found for the British standard phantom and for the NEMA phantom. Similar thresholds for other contrast concentrations can be used to pre-define exposure modes, which may be chosen by the radiologist during the procedure depending on the imaging task.
Conclusion: Dose optimisation of devices featuring digital subtraction can be carried out with a single dedicated phantom. The exposure modes can be adjusted to tasks of different complexity by simultaneous measurement of dose and quantification of image quality.
Author Disclosures:
H. de las Heras: Consultant; QUART GmbH.

B-1023 14:09

Comparison of image quality and radiation dose measurements between an image-intensifier system and a solid-state detector system

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Purpose: To compare image contrast, image resolution and radiation dose between an image-intensifier based system and a solid-state detector based system both used in a paediatric radiology unit.
Methods and Materials: Using a technical phantom (Primus DL, IBA, Germany) two imaging systems---a conventional image-intensifier system (Philips Easy Diagnost, Philips Healthcare, The Netherlands) and a new solid-state detector system (Luminos Agile, Siemens Healthcare Sector, Germany)---were compared. Dosimetry was performed by an ion chamber and by the dose area product. Image contrast and image resolution were evaluated visually by comparing the number of detectable contrast objects and the number of line pairs per millimetre (lp/mm), respectively. Two different modes---a fluoroscopic (20 sec exposure time, 3 pulses per sec, 5 measurements) and a radiographic mode---were compared in all possible magnifying steps.
Results: Image contrast was equal in both systems. Image resolution was increased by the solid-state detector system in comparison to the image-intensifier system both in the fluoroscopic mode (1.5 lp/mm vs. 1.3 lp/mm) and the radiographic mode (1.9 lp/mm vs. 1.3 lp/mm). Radiation dose was reduced by the solid-state detector system in fluoroscopic mode (0.9 vs. 2.7 mGy, $p < 0.0001$) and in radiographic mode (0.4 vs. 2.2 mGy). Radiation dose reduction measured by the radiation dose area product was equivalent.
Conclusion: With the new solid-state detector system an equal image contrast, higher image resolution and a lower radiation dose can be achieved in comparison to the conventional image-intensifier system. The solid-state detector system is therefore preferred for use in paediatric radiology.
Author Disclosures:
M. Weidner: Equipment Support Recipient; Cooperation with Siemens Healthcare Sector. **T. Diehm:** Equipment Support Recipient; Cooperation with Siemens Healthcare Sector. **S.O. Schönberg:** Equipment Support Recipient; Cooperation with Siemens Healthcare Sector. **K.W. Neff:** Equipment Support Recipient; Cooperation with Siemens Healthcare Sector.

B-1024 14:18

Comparative study of the corrosion behaviour of peripheral stents in a accelerated corrosion model: experimental in vitro study of 28 metallic vascular endoprostheses

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Purpose: Clinical cases of stent-fractures caused by corrosion show that the selection of stents due to their corrosion behaviour might play a role. Implanted in vivo, especially in combination with other implanted foreign-materials, stents are exposed to special conditions, which can cause a process of corrosion.
Methods and Materials: 28 peripheral stents of different materials (nitinol, cobalt-chromium-nickel, tantalum, V4 A) and surface treatments (electro-polishing, mechanical-polishing, without polish) were tested in vitro. Corrosion was accelerated by applying a constant voltage of 3.5 volts and amperage of 1.16 mA in 0.9% NaCl. At defined points-of-time, the stents were investigated for macroscopic and microscopic damage.
Results: Nitinol stents showed the lowest susceptibility to corrosion and the longest period without damage. The Memotherm II was the only stent that showed neither macroscopic nor microscopic damages. The worst material was cobalt-chromium-nickel. Here corrosion damages already occurred about 1/10 earlier compared to nitinol. Considering the reasons for determination of the test nitinol stents primarily showed length deficits, V4 A and tantalum stents mainly fractures. Cobalt-chromium-nickel stents had half a fraction in multiple parts or a complete lysis. Placed in direct contact nitinol stents came out on top, regardless of what material they were combined with. Testing the influence of polishing treatments, electro-polished stents performed best, mechanical-polished and stents without polishing treatment followed.
Conclusion: All available stents are actual a compromise on advantages and disadvantages. The analysis of the corrosion behaviour is thus a necessary basis to provide a large number of different stents to fulfill the individual needs of patients.

B-1025 14:27

Radiation doses to patients in interventional cardiology procedures

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Purpose: A number of procedures in cardiology are performed under fluoroscopy control with cine series, e.g. coronary angiography (CA), percutaneous transluminal coronary angioplasty (PTCA), closure of patent foramen ovale (PFO), implantation of pacemakers (PM) and implantable cardioverter-defibrillators (ICD), but also electrophysiological procedures (RFA). It is not long ago when transcatheter implantations of aortic valve (TAVI) began. This study provides information about radiation burden of patients undergoing mini-invasive cardiological procedures.
Methods and Materials: All procedures except implantation of PM and ICD were performed on angiography x-ray systems (2005-2012) which provides the radiation dose structured report useful for assessment of patient doses. Implantations of PM and ICD are performed on a different x-ray system, providing only total PKA and fluoroscopy time. For patient's dose assessment, only PKA values were used. In this study, a following number of patients were included: CA-517, CA+PTCA-157, PFO-13, PM-94, ICD-94, RFA-250, TAVI-22. The CA group includes not only patients with coronary angiography, but sometimes left ventriculography was a part of exam. The RFA group includes patients treated for atrial fibrillation, atrial flutter, and other.
Results: Average values of PKA (Gy.cm2) are as follows: CA-39 Gy.cm2, CA+PTCA-94 Gy.cm2, PFO-21 Gy.cm2, ICD-26 Gy.cm2, PM-17 Gy.cm2, RFA-10 Gy.cm2, TAVI-249 Gy.cm2.
Conclusion: Highest doses are associated with TAVI and lowest with RFA. According to the number of procedures performed annually, doses from CA+PTCA most significantly contribute to the collective effective dose.

B-1026 14:36

European skin-dose trigger levels for interventional radiology and cardiology procedures

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Purpose: The large use of fluoroscopy in interventional radiology procedures may induce unintended patient skin injuries. To help physicians and staff recognise and avoid situations at risk, trigger levels based on online dosimetric indicators, available on most of the new angiography equipment, have been introduced. However, such trigger levels are usually centre and procedure dependant. This work aims to evaluate the feasibility of establishing a European set of trigger levels for high-risk interventional procedures.
Methods and Materials: Within EURADOS WG12 9, European countries performed measurements in clinical settings to evaluate the correlation between maximum skin dose (MSD) and cumulative air kerma (CK) at the reference interventional point. This easy-to-use method provides the staff with real-time MSD estimates. The study focused on the PTCA (coronary angioplasty), NE (neuroembolisations) and CE (chemoembolisations) procedures which extensively use x-rays.
Results: The MSD showed good correlation with CK for the evaluated procedures despite the multiple factors affecting MSD including skin dosimetry uncertainties, operator's experience and methodology. Two provisional European trigger levels have been established: 5.5 Gy for CE and 2.5 Gy for NE which indicate a 3 Gy skin dose. Trigger level for PTCA is still under evaluation.
Conclusion: Trigger levels are still a necessary tool, until real-time dose mapping systems become available on angiographic equipment to identify situations associated with high probability of exceeding the dose threshold for deterministic effects. Future steps will include extending the work to other radiology procedures pooled depending on their tube projections, field of view and equipment protocols.

B-1027 14:45

Monte Carlo reference data sets for imaging research: results of the American Association of Physicists in Medicine (AAPM) task group no. 195

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Purpose: To develop a set of reference Monte Carlo simulations relevant to diagnostic imaging research for use by researchers needing to validate their own simulations.
Methods and Materials: Complete details of six different Monte Carlo simulations relevant to x-ray diagnostic imaging have been developed and implemented using four well-established software packages (EGSnrc, Geant4, Penelope and MCNP). The simulations implemented are: x-ray half value layer characterisation; dosimetry and x-ray scatter in radiography, mammography, body and breast tomosynthesis; dosimetry in body CT; and x-ray production. Results obtained with the four software packages were compared. The Task Group report includes complete details of the simulation conditions and all results.
Results: Excellent agreement was found among the four implementations of all six simulation conditions. The simulation of x-ray production showed the largest differences among the different codes due to the complexity of the physics involved and the many physics parameter options available in each code. During implementation of the simulations, many lessons were learned on differences in interpretation of simulation conditions and behaviour of the software packages. These are included in the Task Group report. The relative efficiency of the codes varied considerably.
Conclusion: When simulation conditions were equivalent, results obtained with the four Monte Carlo packages tested were consistent. However, ensuring that all simulation conditions match is not straightforward. The publication of the details of all simulation conditions and results will be useful to other researchers who need to validate their own Monte Carlo simulation software.

B-1028 14:54

Quantitative assessment of the spatial dependence of non-stationary high-contrast spatial resolution, low-contrast detectability, and noise behaviour in 3D imaging of the breast

C. Steiding, D. Kolditz, A.-C. Roessler, W.A. Kalender;
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Purpose: To investigate the dependence of objective image quality (IQ) metrics on direction and position in the 3D volume for breast tomosynthesis (BT) and breast computed tomography (bCT).
Methods and Materials: In addition to standard IQ procedures, we focused on assessing physical imaging performance in the central and the peripheral field of measurement (FOM) in radial, azimuthal, and axial direction. Two homogeneous tissue-equivalent phantoms mimicking compressed and pendant female breasts were designed and equipped with identical test inserts. For the evaluation of in-plane and axial resolution, 3D low-contrast detectability, and spatially-dependent noise behaviour, the modulation transfer function's 10% value (MTF10%), slice sensitivity profile's full width at tenth maximum, object size-dependent contrast-to-noise ratio (CNReff), and local noise power spectra (NPS) were determined. Measurements were carried out on a clinical BT and a prototype high-resolution bCT system at comparable dose levels.
Results: Both modalities showed MTF10% >5 lp/mm in the center and spatially asymmetric noise behaviour of local volumes through 3D NPS estimation. Massive discrepancies between in-plane and axial system response was determined in BT, while bCT featured isotropic resolution. In BT, the smallest low-contrast insert (2 mm) was not revealed in the center, as indicated by CNReff < 5. For bCT, CNReff was significantly higher and all low-contrast structures were visible regardless of their position.

Conclusion: Assessing only transverse system response in the central FOM appears to be insufficient since resolution, image contrast, and noise depend critically on direction and position.
Author Disclosures:
C. Steiding: Employee; CT Imaging GmbH. **D. Kolditz:** Employee; CT Imaging GmbH. **W.A. Kalender:** CEO; CT Imaging GmbH. Founder; CT Imaging GmbH.

B-1029 15:03

Evaluation of DNA damage induced by total body CT scans
N. Della Vecchia, F. Giurazza, R. Del Vescovo, B.B. Zobel; *Rome/IT (nico.dvecchia@libero.it)*

Purpose: The cellular damage induced by ionizing radiation has been previously quantified analyzing the DNA double strand breaks (DSBs) in lymphocytes through the rate of γ-H2 AX phosphorylated histone protein. We aimed to demonstrate and quantify molecular damage induced from ionizing radiation by evaluating the expression of histonγ-H2 AX in lymphocites of patients who underwent CT scan evaluation.
Methods and Materials: 30 patients (15 males, 15 females) underwent full-body CT scan for oncological diseases. The mean radiation dose delivered was 101.63 mGy. Three blood samples have been taken for analysis: immediately before the emission of radiation (T0), 15 minutes and 30 minutes after the beginning of the exam (T1 = T0 +15 min, T2 = T0+ 30 min). Cell preparations were afterwards examined with FACS (fluorescence-activated cell sorting).
Results: At T1, in 90% of cases, we identified the presence of cell damage in terms of increased expression of γ-H2 AX of about 27%. At T2, in 36% of the samples we appreciated a reduction in the expression of γ-H2 AX compared to T1, probably linked with activation of cellular repair mechanisms; in the remaining 64% of cases, we found increasing expression of γ-H2 AX, suggesting damage progression.
Conclusion: Already 15 minutes after in vivo ionizing radiation exposure, like CT exams, a significant nuclear damage in terms of DNA DSBs is appreciable; in some cases, it seems that the human organism activates in short-time mechanisms of biological repair able to reduce this damage.

B-1030 15:12

Small animal imaging with a preclinical x-ray phase-contrast and dark-field scanner
A. Yaroshenko[1], A. Velroyen[1], M. Bech[1], A. Tapfer[1], M. Müller[1], B. Pauwels[2], P. Bruyndonckx[2], A. Sasov[2], F. Pfeiffer[1]; [1]*Garching/DE*, [2]*Kontich/BE (andre.yaroshenko@mytum.de)*

Purpose: The purpose of this study was to demonstrate that a compact small-animal x-ray phase-contrast and dark-field scanner yields superior soft-tissue contrast and complementary information, when compared to the conventional absorption-based imaging.
Methods and Materials: We developed a compact preclinical scanner that acquires conventional x-ray absorption simultaneously with phase-contrast and dark-field images. This is achieved by placing a three-grating interferometer in the beam. This is the first scanner that has a grating interferometer implemented on a rotating gantry. The scanner was used to acquire a CT scan of an ex vivo 10-week-old C57BL/6N mouse, fixated in formalin. Subsequently, a C57BL/6N in vivo mouse was imaged using the scanner in a radiography mode. During image acquisition the mouse was breathing freely.
Results: The phase-contrast CT of the ex vivo mouse showed significantly higher soft-tissue contrast than the conventional absorption CT, e.g. in the abdomen region. On the acquired projection image of an in vivo mouse, the lung is clearly visible in the dark-field modality. Furthermore, the trachea is clearly visualised in phase-contrast, whereas bones are best visible in the absorption modality.
Conclusion: It has been observed that dark-field radiography has a very high potential for lung imaging, as the signal-to-noise ratio is much higher than in other imaging modalities. Furthermore, it has been shown that the developed rotating gantry is stable for CT acquisition. In fact, all ex vivo CT results showed superiority of the x-ray phase-contrast imaging for biomedical applications.
Author Disclosures:
B. Pauwels: Employee; Bruker microCT. **P. Bruyndonckx:** Employee; Bruker microCT. **A. Sasov:** CEO; Bruker microCT.

B-1031 15:21

Automatic assessment of upper urinary tract clearance during the initial phase of digital pyelography
I.S. Leichter, V. Neeman, E.Y. Panfil, O. Gleisner, R. Morag, M. Duvdevani; *Jerusalem/IL (Izhak@hadassah.org.il)*

Purpose: Upper urinary-tract clearance, affected by kidney pathologies, is currently estimated by visual monitoring of contrast-media clearance from the renal pelvis in retrograde or antegrade pyelography. Since such estimation involves high radiation dose and is very subjective, this study explores a new computerised method for assessing quantitatively upper urinary-tract clearance, using only images from the initial phase of pyelography.
Methods and Materials: The computerised method is based on analyzing the radio-density of the contrast-media in sequential pyelography images. 55 patients following PCNL and retrograde or antegrade pyelography were studied. 18 of the patients experienced known kidney pathologies. Following image normalisation by a novel phantom attached to the patient, the integrated optical-density of the contrast-media in the renal pelvis was analysed quantitatively in sequential images, to yield clearance curves. Significance of differences was calculated by Pearson t-test.
Results: For all patients, the obtained clearance curves highly fitted exponential regression and the relative clearance-rate per minute was calculated. The mean clearance rate per minute for the pathologic cases (7.78%) was significantly ($p < 0.001$) lower than for normal cases (50.45%). Measurements showed that after the first 3 minutes of pyelography the relative clearance of contrast-media was already significantly lower ($p < 0.001$) for pathologic cases (19.5%) compared to normal cases (70.8%).
Conclusion: The mean clearance rate measured by the new method for normal patients was about 6.5 times higher than of pathologic cases. The differences in clearance-rate were already significant after the first 3 minutes of pyelography, providing an accurate quantitative assessment with reduced radiation dose.

14:00 - 15:30 **Room N/O**

Vascular

SS 1815

Carotid pathology evaluation

Moderators:
P. Almeida; Coimbra/PT
P. Minko; Homburg a.d. Saar/DE

B-1032 14:00

Atherosclerotic plaque texture from 3D carotid ultrasound improves prediction of vascular events
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Purpose: To compare the predictive value of change in carotid ultrasound derived plaque texture (ΔTexture), change in total plaque volume (ΔTPV), and a combination of those two measures, for the occurrence of vascular events.
Methods and Materials: 298 patients with carotid atherosclerosis were scanned with 3D-US at baseline and after one year. Plaque volume and 376 measures of texture were measured in all plaque areas at both time points. Patients were followed up to 5 years for occurrence of myocardial infarction, TIA, stroke and death due to vascular causes. Sparse Cox Regression was used to select the most predictive texture measures and to combine them into one risk measure. Selection and combination of texture measures, and combination with ΔTPV, was performed in independent training sets using a tenfold cross-validation to ensure unbiased results.
Results: Kaplan-Meier analysis showed improved predictive value for ΔTexture and ΔTPV combined (difference between tertiles: $p < 0.001$) compared to ΔTexture ($p < 0.01$) and ΔTPV ($p=0.039$) individually. In Cox regression, adjusted for 13 clinical parameters including age, sex, smoking status, cholesterol, diabetes and previous events, ΔTexture (HR=1.66, $p=0.012$) and ΔTPV (HR=1.47 per 100 mm3, $p=0.001$) were both significant predictors of vascular events, with no other traditional risk factors being significant.
Conclusion: Changes in plaque texture and in plaque volume are both predictive of vascular events, and have higher power than more traditional risk factors. Their combination improves predictive value, and therefore may be relevant to include in the monitoring of patients and for risk stratification in vascular disease.

Author Disclosures:
A. van Engelen: Research/Grant Support; CTMM, the Center for Translational Molecular Medicine, project Parisk grant 01C-202; the Dutch Heart Foundation; the Erasmus Trustfund. **J.D. Spence:** Research/Grant Support; Heart & Stroke Foundation of Canada (Ontario), grant number NA5912.

B-1033 14:09

Microvesicle protein CD14 levels reflect carotid intima-media thickness in 8-year-old children

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Purpose: Atherosclerosis, a process that begins in childhood, develops over decades and underlies the majority of cardiovascular events. In adults, microvesicle (MV) proteins relate to atherosclerotic disease. However, little is known about the relation of MV proteins with atherosclerosis in children. This study evaluates the relation between levels of MV proteins CD14, Serpin F2, Serpin G1 and cystatin C and vascular characteristics in children.
Methods and Materials: In 8-year-old children of the ongoing Wheezing-Illnesses-Studie-LEidsche-Rijn (WHISTLER) birth cohort, anthropometrics and blood pressure were measured. Common carotid intima-media thickness (CIMT), carotid distensibility and carotid elastic modulus were obtained non-invasively. In 130 children, a fasting lipid spectrum was acquired and MVs were isolated from plasma. MV protein levels of CD14, Serpin F2, Serpin G1 and cystatin C were measured using a multiplex assay. In a multivariable model, we assessed the relationship between these MV proteins and vascular characteristics.
Results: Of the MV proteins under study, CD14 levels were positively associated with CIMT ($\beta=4.09\times10^{-4}$, p=0.019). This association proved to be dependent on total cholesterol levels (p=0.049 for interaction). Only in children who had low total cholesterol levels (≤4.4 mmol/L, mean of total), MV protein CD14 levels were positively related with CIMT ($\beta=4.98\times10^{-4}$, p=0.024). There were no significant associations between levels of MV proteins and distensibility or elastic modulus.
Conclusion: In children with low total cholesterol levels, MV protein CD14 levels are positively related to the degree of CIMT. Therefore, MV protein CD14 levels may be useful markers for atherosclerosis burden from childhood onwards.

B-1034 14:18

Carotid plaque vulnerability: could contrast enhanced ultrasound play a role in patient management?

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Purpose: To assess a relationship between CEUS and immuno-histological evaluation of carotid artery "inflammatory-vulnerable plaque".
Methods and Materials: 50 consecutive patients (18 symptomatic; 32 asymptomatic) referring to our Department in order to perform carotid endarterectomy, were enrolled. Ultrasound examination was performed using high-frequency (8-14MHZ) linear probe and a non-linear pulse inversion technique during a double contrast media injection (Sonovue,2-4 ml; Bracco, Italy). Two videotapes were recorded for every injection: early "dynamic" phase and late "flash" phase, performed with 6 high mechanical index impulses. Movies were evaluated in terms of intraplaque enhancement and proliferation of adventitial vasa vasorum both qualitatively, on the basis of a 4-point scale, and quantitavely, using Esaote Qontrast 4.0 software. After surgical resection, plaque specimens were evaluated immunohistologically in order to assess neovascularisation. Qualitative and quantitative evaluation were statistically compared to immunohistological results, considered as gold standard.
Results: Qualitative CEUS evaluation obtained high statistical results when compared to immunohistological results, with values of sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and diagnostic accuracy of 94%, 68%, 87%, 85% and 86%, respectively, which became higher if considering only asymptomatic patient, with a NPV of 91%. Nevertheless, quantitative software evaluation proved less effective and couldn't reach similar results.
Conclusion: Carotid plaque enhancement assessed with CEUS well correlates with histological density of neovessels, which is associated with plaque vulnerability. CEUS may provide valuable information for plaque risk stratification and may play a role in the indication to treatment of patients with carotid stenoses, particularly in asymptomatic population.

B-1035 14:27

The relationship between the volume of carotid bodies assessed by computed tomography angiography and cardiac autonomic function in patients with essential hypertension

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Purpose: Determine the relationship between the estimated volume of the carotid bodies ($V_{rCB+ICB}$) assessed by computed tomography angiography (CTA) and the autonomic cardiac function in patients with essential hypertension (EH).
Methods and Materials: The study included 22 consecutive individuals with diagnosed and treated pharmacologically EH. Estimated volume of each carotid body (CB) was evaluated on the basis of scans obtained in the CTA of carotid and vertebral arteries, using the formula: 4/3π x transverse dimension of CB in axial projection x CB longitudinal dimension in the axial projection x CB craniocaudal dimension in the sagittal/frontal projection. Autonomic cardiac function was assessed using analysis of heart rate variability (HRV). Time domain HRV parameters: mRR, SDNN, SDANN, SDNNi, rMSSD, pNN50 were obtained.
Results: Mean values of rMSSD and pNN50 were significantly lower in patients with hypertension with the values of $V_{rCB+ICB}$≥median, compared to the group of hypertensive patients with the values of $V_{rCB+ICB}$<median (rMSSD: 50.18±10.15 ms vs. 64.63±6.18 ms, $p < 0.05$; pNN50: 10.73±2.49 % vs. 13.27±4.01 %, $p < 0.05$). Statistically significant negative linear correlations was demonstrated between $V_{rCB+ICB}$ and rMSSD and between $V_{rCB+ICB}$ and pNN50 (r: -0.33, -0.48). Based on the regression analysis it has been shown that the higher values of $V_{rCB+ICB}$ are an independent risk factor in HRV reduction in patients with EH.
Conclusion: In patients with EH a relationship between the volume of CB assessed by CTA of carotid and vertebral arteries and autonomic cardiac function seems likely, especially in terms of parasympathetic component.

B-1036 14:36

T1- and T2-weighted SE carotid plaque imaging and contrast-enhanced MR angiography in comparison with intravascular ultrasonography: qualitative and quantitative assessment

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Purpose: The study aimed to assess in vivo quantitative and qualitative plaque features on 1.5 T carotid MR imaging and CE-MRA in comparison with standard-IVUS.
Methods and Materials: 20 pts (age73±9yr,9females) with symptomatic carotid stenosis 50%-90% initially detected in USG were enrolled. Patients underwent carotid MRI and MRI carotid angiography one to two weeks before conventional angiography with IVUS study and PCI. Patients were studied with a whole-body MR imaging scanner (Aera, Siemens) using 4-channel phased-array surface head and neck coil. MR pre-contrast images were obtained with 3-DTOF, inversion recovery pre-contrast T1, double inversion T2 and proton density fat saturation (in plane resolution 0.7x0.7x2 mm). Carotid angiography was obtained with bolus tracking method and study inversion recovery CE-T1 5 minutes after intravenous infusion of 0.2-mmol gadoteridolum/kg. MRI images were transferred and analysed on commercially available software. IVUS imaging was performed using Volcano Therapeutics® EagleEye Gold catheter and Volcano Therapeutics®IVG3 OracleImaging System. Spearman rank correlation and p value for 95% CI were calculated for measured parameters.
Results: There was no statistical difference (p0.07) between pre-contrast MRI (T1,T2 imaging) and IVUS calculations of maximal plaque area, minimal lumen diameter, area, reference area, area and plaque volumen, stenosis assessment. Low correlation rho 0.55 and p value > 0.11 were found in measurements of CE angiography stenosis as compared with IVUS. The overall high-signal intensity (PD imaging) and high-contrast enhancement correlated with large complicated fibroatheroma ($p < 0.01$).
Conclusion: 1. T1WI and T2WI are useful to quantitative assessment of carotid plaque 2. CE angiography weakly correlated with IVUS stenosis measurements 3. T1 contrast study and PD imaging could be useful for detection of complicated and advanced plaques.

B-1037 14:45

Prevalence, distribution and outcome of patients with calcified nodules in carotid arteries

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Purpose: Calcified nodules are responsible for up to 5% of coronary infarcts and are therefore classified as a minor criteria of the "vulnerable" atherosclerotic plaque. We sought to evaluate the prevalence, distribution and outcome of patients with calcified nodules in the carotid arteries.

Methods and Materials: 108 consecutive patients (90 with unilateral ischaemic stroke, 37 female) with carotid plaques ≥2 mm by duplex ultrasound underwent a carotid black-blood 3 T-MRI with fat-saturated T1w-, PDw-, T2w- and TOF images using dedicated surface coils. Based on previous histological validation, calcified nodules were defined as distinct calcification with an irregular, protruding, and convex luminal surface. Prevalence of calcified nodules was determined in both common and internal carotid arteries in consensus by two reviewers who were blinded to clinical information.
Results: In total, 18 calcified nodules in 13 distinct arteries of 12 distinct patients were identified. Calcified nodules were more commonly found in the common compared to the internal carotid artery (11 vs. 7), in asymptomatic compared to symptomatic arteries (8.2 vs. 3.4%) and in arteries with ≥50% compared to arteries with < 50% stenosis (10% vs. 5.3%); although all these differences were not statistically significant (P=0.34, 0.15 and 0.26, respectively).
Conclusion: Calcified nodules were found in approx. 10% of patients with carotid plaques ≥2 mm by duplex ultrasound. We were not able to establish an association of calcified nodules and ischaemic symptoms, suggesting that calcified nodules play a minor role in the pathogenesis of ischaemic stroke in the carotid arteries.

B-1038 14:54

Quantitative x-ray phase-contrast Hounsfield units for the differentiation of carotid atherosclerotic plaque components

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Purpose: Conventional CT can distinguish between soft, mixed and calcified plaques but has difficulties to further differentiate soft plaques due to an overlap in Hounsfield units of fibrous and lipid tissue. Phase-contrast imaging is a novel x-ray-based imaging technique that relies on the x-ray phase-shift rather than its absorption, yielding a higher contrast in biological soft tissue. We sought to evaluate whether plaque components can be differentiated based on their phase-contrast HU (HU-P), which can be calculated in analogy to absorption-contrast HU.
Methods and Materials: Four ex vivo human carotid arteries were imaged at a laboratory-based set-up using a conventional x-ray tube (35 kV) and grating-interferometer. Tomographic images were reconstructed with an effective pixel size of 100 µm and correlated with histopathology sections. Regions corresponding to fibrous, lipid or calcified tissue based on histopathology were manually traced. Mean HU-P were calculated for all analysed regions.
Results: A total number of 80 cross-sections with 72 fibrous, 19 lipid and 24 calcified tissue containing regions were assessed. Fibrous, lipid and calcified tissues were associated with significant different mean HU-P (52.6±7.0, 21.0±9.8 and 371.5±158.0, $p < 0.001$). Furthermore, there was no overlap of HU-P between fibrous (range 44.9 - 63.3) and lipid tissue (3.1-30.1). Similarly, no overlap of HU-P was observed between calcified tissue (range 174.4 - 593.7) and the other tissue components.
Conclusion: In an ex vivo experimental set-up grating-based phase contrast CT can reliably differentiate between calcified, fibrous and fatty tissue based on quantitative HU-P, indicating its high potential for improved assessment of carotid atherosclerotic disease.
Author Disclosures:
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B-1039 15:03

Intra-individual comparison of carotid and femoral atherosclerotic plaque features with in vivo MR plaque imaging

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Purpose: To evaluate differences of plaque composition and morphology within the same patient in different vascular beds using non-invasive MR-plaque imaging.
Methods and Materials: 28 patients (67.8±7.4 years, 8 females) with high Framingham general cardiovascular disease 10-year risk-score and mild-to-moderate atherosclerosis were consecutively included in the study. All subjects underwent dedicated MRI-plaque-imaging-protocol using TOF- and T1w- and T2w-black-blood-sequences with fat suppression (1.5 T). The scan was centered on the carotid bulb of the carotid and on the most stenotic lesion of the femoral arteries, respectively. Plaques were classified according to the American-Heart-Association lesion type classification and area measurements of lumen, wall and the major plaque components, such as calcification, necrotic core and haemorrhage were determined in consensus by two blinded reviewers using dedicated software. Plaque components were recorded as maximum percentages of the wall area.
Results: Carotid arteries had larger maximum wall and smaller minimum lumen areas ($P < 0.001$). Prevalence of lipid-rich AHA-lesion-type-V and complicated AHA-lesion-type-VI with haemorrhage/thrombus/fibrous-cap rupture was significantly higher in the carotid arteries compared to the femoral arteries. Plaque composition as percentage of the vessel wall differed significantly between carotid and femoral arteries: Max. %necrotic core and max. %haemorrhage were significantly higher in carotid arteries compared to femoral arteries (P=0.001 and P=0.02, respectively). Max.%Calcification did not differ significantly.
Conclusion: In vivo MRI is able to visualise differences in plaque composition of distinct vascular beds within the same patient. More specifically, the plaque phenotype and thus the extent of atherosclerosis differs within the same patient across different vascular beds.

B-1040 15:12

Genetic and environmental effects on carotid flow velocities: an international twin study

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Purpose: Altered carotid blood flow velocities (CFV) have a complex background but the underlying genetic contribution is still unclear.We sought to evaluate the influence of genetics, shared and unshared environmental components on individual differences of CFV.
Methods and Materials: 193 healthy twin pairs,126 monozygotic (MZ) and 67 dizygotic (DZ)(mean age 53±14 years)recruited in Italy, in the United States and in Hungary underwent bilateral color-coded Doppler flow assessment of the common carotid artery (CCA)and of the internal carotid artery (ICA)in order to assess the peak systolic (PSV) and end diastolic (EDV)velocities.Means of bilateral CFV values were used in the analysis.
Results: Age- and country-adjusted intra-class correlations were higher in monozygotic than in dizygotic pairs for mean PSV of the ICA indicating a heritability of 63%. Unique environmental factors contributed to 37% of ICA PSV.With regards to the mean PSV and EDV of the CCA, and EDV of the ICA, heritability analysis indicated no discernible role for genetic components, while the contributions of shared and unshared environmental factors ranged between 56% and 63%, and between 37% and 44% adjusted for age and country, respectively.ICA/CCA ratio was driven by unique environmental factors (81-88%)with negligible heritability (0-12%).
Conclusion: Our study showed that the heritability of ICA PSV is moderate, while the findings do not support heritability of other investigated CFV values.Environmental effects account for a moderate to major portion of the variance.These findings support the value of early ultrasound screening as well as the prevention of modifiable environmental factors in case of altered carotid flow-velocities.

B-1041 15:21

Carotid artery dissection in CT: does the colour improve the diagnostic confidence of the readers?

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Purpose: To evaluate if the use of chromatic analysis, instead of the use of gray-scale, in the MDCTA study of carotid artery dissection (CAD) modify the observer's diagnostic accuracy.
Methods and Materials: One hundred patients (61 men; mean age, 51 years) 40 with and 60 without CAD, that underwent MDCTA formed the study cohort. Patients from three different groups were included (patients with MR confirmation of CAD, n = 40; patients with MR confirmation of CAD absence, n = 20; patients that underwent MDCTA for suspected atherosclerosis, n = 40). Four blinded observers with different level of expertise analysed the randomised basal scan of the MDCTA dataset. ROC curve analysis, the Cohen weighted test and sensitivity, specificity, PPV, NPV, accuracy, LR+ and LR- were performed.
Results: The ROC curve analysis showed that for all observers the use of chromatic-scale produced an improvement of the diagnostic confidence with AUC values from 0.896 to 0.936; from 0.823 to 0.849; from 0.84 to 0.909 and 0.749 to 0.861 for expert, intermediate A, intermediate B and trainee observers. In particular, the variation of diagnostic confidence (between the AUC areas) for the trainee was statistically significant (p = 0.036). Also accuracy, as well as sensitivity, specificity, PPV, NPV, LR+ and LR- were better using the chromatic scale
Conclusion: Results of our study suggest that the use of chromatic scale instead the classic gray-scale improves the diagnostic confidence of the readers, in particular of the junior ones, by improving also the accuracy, sensitivity and specificity.

14:00 - 15:30 **Conf. Room M3**

Interventional Radiology

SS 1809

Embolisation including radioembolisation

Moderators:
J.I. Bilbao; Pamplona/ES
N. Ptohis; Athens/GR

B-1042 14:00

Yttrium-90 radioembolisation vs sorafenib for hepatocellular carcinoma: a cohort study with a propensity score analysis

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Purpose: Sorafenib and transarterial ^{90}Y-radioembolisation (TARE) are possible treatments for Barcelona Clinic Liver Cancer (BCLC) intermediate-advanced stage hepatocellular carcinoma (HCC). No study directly comparing sorafenib and TARE is currently available. This study compares patient outcomes achieved with these therapies.
Methods and Materials: This retrospective study evaluated 112 patients treated with sorafenib and 73 with TARE. Selection criteria: Child-Pugh class A/B, performance status ≤1, HCC unfit for effective therapies, no metastases and previous systemic chemotherapy. Propensity analysis provided one-to-one match between sorafenib and TARE patients for independent prognostic factors.
Results: Seventy-four sorafenib (71±10 years, male 87%, BCLC B/C 53%/47%) and 63 TARE patients (66±9 years, male 79%, BCLC B/C 41%/59%) were included in the analysis. Median overall survival was 14.4 months (95% CI: 4.3-24.5) in sorafenib and 13.2 months (6.1-20.2) in TARE patients, with 1-, 2- and 3-year survival rates of 52.1%, 29.3% and 14.7% versus 51.8%, 27.8% and 21.6%, respectively (P=0.959). Two TARE patients underwent liver transplantation after successful downstaging. After the propensity model had matched 32 patients of each group for median age, tumour gross pathology and the independent prognostic factors (portal vein thrombosis, performance status, Model for End Liver Disease), the median survival was 13.1 months (1.2-25.9) in sorafenib and 11.2 months (6.7-15.7) in TARE patients, with 1-, 2- and 3-year survival rates of 53.1%, 23.0% and 15.3% versus 44.7%, 19.0% and 9.5%, respectively (P=0.392).
Conclusion: In cirrhotic patients with intermediate-advanced or not-otherwise-treatable HCC, sorafenib and TARE provide similar survivals. Down-staging allowing liver transplantation only occurred after TARE.

B-1043 14:09

Safety of radioembolisation with 90Yttrium-microspheres depending on coiling or no-coiling of aberrant vessels

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Purpose: To evaluate the safety of radioembolisation with 90Yttrium-microspheres depending on coiling or no-coiling of aberrant vessels.
Methods and Materials: The early and late toxicities of 400 radioembolisation procedures were retrospectively analysed according to the National Cancer Institute's Common Terminology Criteria for Adverse Events (CTCAE v3.0). In 200 procedures the aberrant vessels were coiled prior to radioembolisation and in 200 procedures we chose a more peripheral position to treat the right or left liver lobe.
Results: Except for one instance of treatment-associated cholecystitis (grade 4 toxicity) there were no acute or delayed toxicities according to the CTCAE criteria higher than grade 2. No radiation-induced liver disease was noted. There was no significant difference ($p > 0.05$) in acute or delayed toxicities depending on actually recommended coiling of aberrant vessels prior to treatment in comparison to choosing a peripheral treatment position.
Conclusion: Radioembolisation with 90Yttrium-microspheres is a safe and effective treatment option. Performing of radioembolisation without coiling aberrant vessels prior to treatment could be an alternative option for experienced centers.

B-1044 14:18

Yttrium-90 radioembolisation for the treatment of unresectable liver cancer or liver metastases from gastrointestinal system cancers: results of a one-center study

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Purpose: To determine the effects of yttrium-90 (Y-90) resin microsphere radioembolisation therapy on patients with unresectable liver cancer who do not benefit from chemotherapy.
Methods and Materials: Fifty-five patients underwent radioembolisation therapy between 2010 and 2012 were included in the study. All of these patients had unresectable primary or metastatic liver cancer originating from the gastrointestinal tract. Three were excluded from the study after pre-evaluation angiography. Thirteen (23.6%) of the remaining 52 patients had hepatocellular carcinoma and 39 (76.4%) had metastatic liver cancer. Fifty-two patients underwent Y-90 radioembolisation treatment. After the procedure, clinical follow-up of each patient was retrospectively conducted using our hospital's data processing programs. Each patient's response to the administered treatment was evaluated using the Response Evaluation Criteria in Solid Tumors (RECIST) and the overall probability of survival was displayed graphically by the Kaplan-Meier method.
Results: Fifty-five patients underwent pre-evaluation angiography had their extrahepatic branch embolised (46 gastroduodenal artery, 3 accessory right gastric artery, 2 supraduodenal artery) for hepatic arterial isolation. Fifty-two of them that were evaluated using gamma camera imaging with macroaggregated albumin were determined to be suitable for treatment. After Y-90 therapy, 47 patients were follow-up. While 57% of the patients responded to treatment as clinical benefit, the disease progressed in 43%. The median hepatic progression-free survival time of the patients was 3.4 months (95% confidence interval (CI):1.4-5.3) and the overall survival time was 11.3 months (95% ci:8.7-14.03).
Conclusion: This study emphasises that Y-90 resin microsphere radioembolisation treatment is effective in patients with unresectable liver cancer.

B-1045 14:27

Selective internal radiation therapy of hepatic tumours: is coiling of the gastroduodenal artery always beneficial?

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Purpose: To minimise the risk of extrahepatic 90-yttrium (90Y) deposition. the gastroduodenal artery (GDA) is often coil embolised before SIRT.The aim of this study was to assess the effect of GDA occlusion with regards to arterial hepato intestinal collateralization (HIC).
Methods and Materials: 606 patients were scheduled for SIRT between 2006 and 2012 at our hospital. Digital subtraction angiography (DSA) followed by 99m-technetium labelled human serum albumin microspheres (99mTc-HSAM) administration and SPECT/CT was initially performed. Depending on vascular anatomy and hepatic tumor load, GDA coil embolisation was considered. In subsequent 99mTc-HSAM, rescans or the therapeutic DSA HIC and its consequences for SIRT were analysed.
Results: In 86 of 606 patients (14%), the GDA was occluded. 22 of these 86 patients did not undergo SIRT due to the patients' clinical status or SIRT contraindications. In 28 of the remaining 64 patients, newly apparent or reopened HIC were seen either at the site of the proximal GDA (*n*=21) or in the periphery of the hepatic arteries (*n*=7). In 25 of these 28 patients, the HIC could be occluded or the catheter position could be changed achieving a safe 90Y application. However, due to the HIC in 3 of 28 patients SIRT was regarded unsafe and was abandoned.
Conclusion: GDA occlusion may induce arterial hepato intestinal collaterals. Although most of these collaterals do not impede 90Y administration, SIRT may become unfeasible in specific occasions. Hence, we recommend segmental or lobar SIRT instead of a whole liver approach with GDA coiling.

B-1046 14:36

Randomised comparison of SIRT and TACE for treatment of intermediate stage HCC

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Purpose: To compare SIRT and DEB-TACE for treating intermediate stage Hepatocellular Carcinoma (HCC).
Methods and Materials: 24 patients with intermediate stage HCC were randomised 1:1 for SIRT or DEB-TACE. In case of recurrence, SIRT was allowed to be repeated once. TACE was repeated every 6 weeks until no viable tumor was detected by MRI. Follow-up included contrast enhanced MRI every 3 months.

Results: There were no differences in terms of demographics and tumor load between both groups. Progression-free survival (PFS) was 180 days for SIRT and 216 days for TACE (Median, n.s). Time to progression (TTP) was of 371 days versus 336 days (n.s). and Overall survival (OS) was 592 days versus 788 days, respectively (n.s). Causes of death were liver failure (predominant in SIRT group), tumor progression (predominant in TACE group), cardiovascular events, and inconclusive.
Conclusion: There was no significant difference in PFS, TTP, and OS after SIRT or TACE. SIRT presented a lower rate of tumor progression but a greater rate of liver failure. This randomised pilot study might be used for sample size calculations of future studies.

B-1047 14:45

Preoperative estimation of remnant liver function using contrast-enhanced ratio following percutaneous transhepatic portal embolisation on Gd-EOB-DTPA-enhanced MRI

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Purpose: The indocyanine green plasma disappearance rate (ICG-K) of the future remnant liver (ICG-Krem) might not provide accurate assessment for estimating heterogeneous liver function owing to percutaneous transhepatic portal embolisation (PTPE). The purpose of this study was to evaluate the contrast-enhanced ratio in the hepato-biliary phase (Enhanced Ratio) on gadoxetic acid disodium (GD-EOB-DTPA)-enhanced MR imaging as a preoperative estimation of future remnant liver (FRL) function in patients undergoing PTPE.
Methods and Materials: In 53 patients, the correlation between ICG clearance and Enhanced Ratio imaging was analysed as preoperative estimation for hepatectomy (first analysis). Twenty-three of 53 patients underwent PTPE for extended hepatectomy and Enhanced Ratio imaging as preoperative estimation after PTPE was analysed (second analysis). Whole liver function and FRL function were calculated on MR imaging as follows: Enhanced Ratio × total liver volume (Enhanced Ratio Index) and FRL Enhanced Ratio × FRL volume (Rem Enhanced Ratio Index), respectively.
Results: ICG-K correlated with the Enhanced Ratio Index (coefficient 0.375, $P = 0.006$), and ICG-Krem strongly correlated with the Rem Enhanced Ratio Index (0.821, $P < 0.001$) at the first analysis. ICG-Krem and the Rem Enhanced Ratio Index were significantly correlated after PTPE (0.597, $P < 0.003$) at the second analysis. The rate of improvement from before PTPE to after PTPE of the Rem Enhanced Ratio Index (48.6%) was significantly higher than that of ICG-Krem (26.4%) ($P < 0.05$).
Conclusion: Enhanced ratio imaging can be used to estimate FRL function after PTPE.

B-1048 14:54

Outcome of emergency trans-arterial embolisation of spontaneous ruptured hepatocellular carcinoma with emphasis of angiography and CT correlation

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Purpose: To analyse the outcome of emergency trans-arterial embolisation (TAE) of spontaneous ruptured hepatocellular carcinoma (HCC) and to correlate the outcome with the angiographic and CT findings.
Methods and Materials: A total 63 patients diagnosed with spontaneous ruptured HCC and unstable hemodynamic status were treated with TAE between Aug 2001 and Jan 2013. 50 males and 13 females with a mean age of 56.8 (range 30-88) followed up for a mean time of 87 months (range 3-138) were retrospectively analysed. The primary end-point was the technical success of embolisation to the target vessel territory. The secondary end-points were clinical successful rate of bleeding control within 30 days, early death within 30 days and embolisation related complications. The angiographic and CT findings were assessed and correlated with the early mortality.
Results: Embolisation was technically successful in 100% cases. The clinical successful rate of bleeding control within 30 days was 97% (61/63). There were 10 cases (16%) of self-limited post-embolisation syndrome. No embolisation related complication, liver failure or treatment-related death occurred. The early 30-day mortality rate was 38% while the overall median survival was 8.75 months. Imaging (angiographic and CT) findings that were associated with early 30-day mortality included large tumour size and partial portal vein thrombosis. Surgical resection were possible in 11 patients with cumulative survival significantly longer than that of patient managed with non-operative treatment (p=0.04).
Conclusion: Emergency TAE is effective and well tolerated treatment for hemostasis of ruptured HCC in patients with hemodynamically unstable condition.

B-1049 15:03

Prostate artery embolisation: preliminary outcomes for symptomatic benign prostate hyperplasia

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Purpose: This pilot project provides guidance for the clinical and logistical feasibility of a larger study evaluating the safety and effectiveness of prostate artery embolisation (PAE) as a treatment for benign prostate hyperplasia (BPH). A multidisciplinary clinical team collaborated to develop a pilot study protocol. BPH will affect the majority of men over age 60. Global quality of life declines as BPH increases. Medical and surgical treatments may be ineffective or unappealing to some.
Methods and Materials: After urologic and imaging evaluation, 10 male BPH patients age 60.6 -93.6 with prostate size 30-170 g (average 84.6) and avg. max urinary flow rate 6.3 ml/sec had PAE. Clinical outcomes include IPSS symptom scores, QOL, prostate size and max flow rate before and after PAE.
Results: There were no technical or device-related procedure complications. 2 patients had delayed episodes of acute urinary retention. Average IPSS scores were 23.3 pre-PAE (range 11-29) and 15.3 (5-25) at 1-month post-PAE. Average prostate size was 84.6 g pre-PAE (30-170) and 57.8 (37-71) at 1-month post-PAE. 8 of 10 reported improved QOL at 1-month post-PAE. One subject was lost to follow-up.
Conclusion: PAE is a clinically viable treatment for BPH. Although the 1-year follow-up period is not quite completed, this series provides guidance for development of larger PAE studies. The primary impediment to this study is logistical. Patients who no longer have significant prostate symptoms may lose interest in follow-up encounters, and may need encouragement to continue with imaging and urologic evaluations to provide data.

B-1050 15:12

Usage of uterine artery embolisation in obstetrical practice

D. Tazhibaev, B. Abishev; *Astana/KZ (abishevb1@mail.ru)*

Purpose: Use of uterine artery embolisation in obstetric bleeding and evaluation of its efficiency.
Methods and Materials: UAE as the prevention of obstetric bleeding in adnation and previa of placenta was made on 54 patients. In 51 cases, UAE were made on pregnant women in terms of 35-40 weeks in combination with caesarean operation. In three cases, UAE were made after caesarean operation to stop post operation uterine bleeding. UAE were done after removal of foetus under the control of the fluoroscopy for preventing embolus reflux into other vessels. Microspheres of 355-1000 micron were used for occlusion of uterine artery.
Results: According to our data in 42 (82.3%) of the 51 observations after bilateral UAE was noticed stable stop of uterine bleeding. In 8 (15.7%) of 51 observations was made amputation of uterus due to the low efficiency of UAE. In one case, uterine amputation was done after bilateral UAE in 10-12 hours because of uterine rebleeding. UAE on the early stage allowed to make certain haemostasis in three cases with bleeding after caesarian operation and to save reproductive organ. The blood-loss during surgery was 500-1200 ml.
Conclusion: As a result, UAE is quite effective method in preventing measures of massive postoperative bleeding in obstetric practice in placenta pathology. In addition, UAE is effective in stopping of uterine bleeding in postoperative period.

B-1051 15:21

Uterine artery embolisation: long-term follow-up of leiomyoma

B. Abishev, D. Tazhibaev; *Astana/KZ (abishevbnncmd1@rambler.ru)*

Purpose: To evaluate fibroid size using ultrasonography (US) and magnetic resonance imaging (MRI) after uterine arteries embolisation (UAE) of leiomyoma.
Methods and Materials: From 2008 to 2013 September, 524 women with symptomatic leiomyoma were treated by bilateral transcatheter UAE. The size of particles depended on uterine arteries diameter and anastomosis between uterine and ovary arteries. Mean age was 35.5 years (range - 20-52).
Results: The moderate reduction of leiomyoma's size was observed in one month after UAE. Decrease of fibroid size determined by US - 18.4%, by MRI - 17.3%, in 1 month. Following reduction of fibroid's size was in 3 months by US - 41%, by MRI - 42.7%, in 6 months by US - 58.4%, by MRI - 59.3%, in 12 months by US - 70.8%, by MRI - 72.7%. Doppler US-control showed blood flow decrease during first month after UAE, in 3 months blood flow data were restored in uterine arteries.
Conclusion: UAE is an effective, minimal-invasive kind of leiomyoma's treatment. MRI and US are the modalities that can accurately estimate fibroid's changes and blood flow in uterine arteries. The tendency of fibroid's shrinkage after UAE is well-defined in period from 1M to 12M. After UAE the blood supply of myometrium is restored according to US Doppler data in the period from 1M to 3M.

14:00 - 15:30 **Board Room A**

Radiographers

SS 1814

Issues in management and delivery of modern imaging services

Moderators:
K. Kupcs; Riga/LV
L.A. Rainford; Dublin/IE

B-1052 14:00

Biocide aerosolisation: a new method for disinfection of radiology department

R. Pintaric[1], J. Matela[1], Š. Pintarič[2]; [1]*Maribor/SI*, [2]*Ljubljana/SI (robert.pintaric@gmail.com)*

Purpose: Hospitals are faced with increasingly resistant strains of microorganisms. When it comes to disinfection, individual parts of electronic equipment of angiology diagnostics such as patient couches of computer tomography (CT) and magnetic resonance imaging (MRI) scanners prove to be very hard to disinfect. Disinfectants of choice are therefore expected to possess properties such as rapid, residue-free action without any damaging effect on the sensitive electronic equipment. This paper discusses the use of the neutral electrolysed oxidising water (EOW) as a biocide for the disinfection of diagnostic rooms and equipment.
Methods and Materials: The CT and MRI rooms were aerosolised with EOW using aerosolisation device. The presence of microorganisms before and after the aerosolisation was recorded with the help of sedimentation and cyclone air sampling. Total body count (TBC) was evaluated in absolute and log values.
Results: The number of microorganisms in hospital rooms was low as expected. Nevertheless, a possible TBC reduction between 78.99-92.50% or 50.50-70.60% in log values was recorded. The research has shown that the use of EOW for the air and hard-surface disinfection can considerably reduce the presence of microorganisms and consequently the possibility of hospital infections. It has also demonstrated that the sedimentation procedure is insufficient for the TBC determination.
Conclusion: The use of biocide aerosolisation proved to be efficient and safe in all applied ways. Also, no eventual damage to exposed devices or staff was recorded.

B-1053 14:09

Service development by radiographer managers: a case study in MRI service portfolio development through a formal research-based process

J. Castillo[1], C.J. Caruana[2], P.S. Morgan[3], C. Westbrook[4]; [1]*San Gwann/MT*, [2]*Msida/MT*, [3]*Nottingham/UK*, [4]*Cambridge/UK (josecast@melita.com)*

Purpose: Ongoing service development is a key activity of the radiographer manager. The purpose of the study was to develop a 2020 MRI service portfolio using a formal research-based approach.
Methods and Materials: A two-round Delphi process was conducted amongst a panel of 11 MRI stakeholder experts which included policy makers, various healthcare professions and patient advocates. Participants' views about the current MRI service catalogue, service pipeline and desired 2020 MRI services were initially elicited through semi-structured interviews which were transcribed and subjected to thematic analysis. An online questionnaire consisting of 43 statements was developed for the second round of the Delphi. Level of agreement was assessed via a Likert scale; with the agreement threshold set at 80%.
Results: Key points of agreement were that the current MRI service catalogue should be maintained, whilst new services such as guided breast biopsies, imaging for oncological purposes (particularly staging of prostate cancer) and enterography should be introduced. There was a lower level of consensus regarding the introduction of breast screening, prostate MRI, 3 T MRI, and MRI-PET fusion with reasons ranging from present low-funding levels to inadequate physics expertise by radiologists, radiographers and medical physicists.
Conclusion: The multi-stakeholder approach adopted ensured that the proposed portfolio was successful in bridging customer needs, professional aspirations and the organisation's strategic intent. It is suggested that radiographer managers adopt such a formal research approach to service development on a routine basis.

B-1054 14:18

Diagnostic value of ultrasound in the detection of rheumatoid arthritis

J. Castro Costa[1], L.A. Torres[1], J.L.M.O. Belo[1], Ó. Tavares[2], A. Saraiva[2], T. Patrão[1]; [1]*Castelo Branco/PT*, [2]*Coimbra/PT (joaocastrocosta@gmail.com)*

Purpose: To compare the articular bone destruction evidenced in the techniques of nephelometry, conventional radiology and ultrasonography.
Methods and Materials: The collected sample universe consisted of 60 patients, in whom the rheumatoid arthritis was diagnosed after the realisation of supplementary diagnosis exams, including nephelometry, conventional radiology and ultrasonography. The rheumatoid factor was quantified by the nephelometry, whilst the number of bone erosions was quantified by radiographies and echographies. The gathered data were analysed by a statistic programme (SPSS version 19).
Results: Rheumatoid arthritis affects both sexes at any group of age, being more common in women between 33 and 41 years old and men between 36 and 41 years old, in a ratio of 7:5. We obtained differences between the number of bone erosions visualised in conventional radiology and the number of bone erosions visualised in ultrasonography ($P < 0.001$). According to the same test, more bone erosions were visualised by ultrasonography in 44 cases, and only in 3 of them more bone erosions were visualised by conventional radiology technique, whilst in the remaining 13 the same number of bone erosions was visualised in both techniques.
Conclusion: Ultrasound is a diagnostic technique that can be used as first line examination in the detection of rheumatoid arthritis, since it uses no ionising radiation and detects a greater number of bone erosions, when compared with conventional radiology.

B-1055 14:27

The impact of real time active dosimetry monitoring during endoscopic retrograde cholangiopancreatography

P.M.N. Mendes, T.A.R. Laranjeiro, G. Paulo, J. Santos; *Coimbra/PT (p.nobre91@gmail.com)*

Purpose: Evaluation of the occupational exposure and analysis of the impact of the use of real time active dosimetry monitoring during endoscopic retrograde cholangiopancreatography (ERCP).
Methods and Materials: Data of staff exposure was collected during 55 ERCP procedures in three separate phases using Raysafe i2 equipment. In phase 1 an active dosimeter was used under the apron; in the phase 2 the dosimeter was above the apron and in phase 3 Raysafe i2 monitor was visible for staff and the dosimeter was used above the apron. Fluoroscopy time was also recorded.
Results: The gastroenterologist and the nurse were the professionals with highest exposure, 6.78μSv and 7.63μSv per procedure. The use of lead apron protection allows the average dose decrease 77%. When showing monitor with real time exposure values the average reduction was 44% to 71% due to behaviour alterations.
Conclusion: The values of occupational exposure for ERCP are similar to the ones found in the literature. All the professionals were informed about the importance of their positioning in the room during the procedure, with the help of real time exposure monitoring. Personal protection and real time dose monitoring are important tools for decreasing occupational exposure.

B-1056 14:36

Is it economically justifiable to let sonographers perform diagnostic ultrasound examination in the upper abdomen? A cost/benefit analyse from a hospital cluster in Norway

K.G. Vikestad; *Oslo/NO (ka-gervi@online.no)*

Purpose: A scientific study from Norway concluded in 2011 that sonographers are qualified to perform ultrasound examinations of upper abdomen equal to radiologists. This is a cost/benefit analyse to explore whether it's justifiable to use sonographers to perform diagnostic ultrasound in the upper abdomen.
Methods and Materials: A cost/benefit analyse where a developed form where used and contained variables as salary, time spent performing reports by the radiologists, time spent and frequency of the sonographers need for assistance by the radiologists, time spent and frequency of examinations where radiologists had to take over the examinations because of the lack of sonographers competence. The form also included a comparison of all the examinations each sonographer made independently, the new tasks that the radiologists find time to do in their saved time, the change of waiting time for ultrasound examinations and change of waiting time of other radiology examinations.
Results: The radiologists' have 36 or 17 hours saved time per week for other tasks as a consequence of using the sonographers to perform all ultrasound examinations in upper abdomen independently. The waiting list for ultrasound examinations of upper abdomen is reduced.
Conclusion: The findings in this study shows that the waiting time is reduced and the radiologists have saved time to perform more examinations with

advanced diagnostic and CT, MRI and conventional x-ray examinations. This study concludes that from a society perspective the benefits are documented, depending on that the society will invest in the sonographer's education.

B-1057 14:45

Assessment of psychosocial risks faced by radiographers in Portugal using the Copenhagen psychosocial questionnaire

J.M. Saude; *Vila Nova de Gaia/PT (mcs@estsp.ipp.pt)*

Purpose: The economic recession and the development of new forms of organisation in health institutions associated with changes in the employment relationship between health workers and employers brings inevitable consequences in psychosocial risks exposures. The aim of the study was to test an instrument for assessing psychosocial risk in radiographers and examine psychosocial risk factors.
Methods and Materials: We conducted a cross-sectional study design based on Copenhagen Psychosocial Questionnaire (short version), completed by 329 radiographers.Sociodemographic and employment characteristics of the participants were also collected. The original structure of the questionnaire was accepted and the internal consistency of each scale was inspected. To assess the internal consistency was used Cronbach's α for the different scales. It was considered that the value $\alpha > 0.70$ as a criterion for a satisfactory internal consistency. A descriptive correlation design is also being made to identify interrelationships between psychosocial risk and workplace environment.
Results: Of the 8 work psychosocial workplace scales of the COPSOQ's short version, 6 showed a satisfactory internal consistency ($\alpha > 0.70$). The scale "Demands at work" ($\alpha = 0.648$) is below that value and the scale "Health in general" has only one item. Further results are expected from the descriptive correlation analysis.
Conclusion: The version of the "Copenhagen Psychosocial Questionnaire" (COPSOQ) "presented appears to be a valid instrument measure the psychosocial work environment of radiographers. Further conclusions are expected from the descriptive correlation analysis.

B-1058 14:54

Setting standards for an MRI unit in Malta: a study in establishing image quality criteria for MRI of the knee joint

S. Attard Mifsud, J. Castillo, F. Zarb; *Msida/MT (suzanne.attard@gov.mt)*

Purpose: The concept of quality criteria was introduced by the Commission of the European Communities (CEC) for most imaging modalities. Despite the complexity of MRI procedures, to date, there are no established image quality criteria for MRI. The purpose of the study was to develop MRI quality criteria for examinations of the knee using a formal research approach.
Methods and Materials: A list of image quality criteria was developed following a review of related literature. Potential anatomical structures were identified, after which content validity was performed by a musculoskeletal radiologist and an orthopedic specialist. Ten pathology free previously reported MR knee examinations, performed on a GE 1.5 Tesla unit at the local general hospital (Malta), each consisting of 3-planar fat-suppressed proton density fast spin echo sequences were evaluated by radiographers. Visual grading analysis was utilised to rate the extent of visibility of each anatomical structure.
Results: Key findings indicate that the current protocol fulfills the developed image quality criteria. The importance of 3-planar imaging and the benefits of tailored protocols which highlight the anatomical structures under investigation therefore contributing to diagnostic accuracy were among the results emerging after implementation of these criteria in the clinical setting.
Conclusion: Image quality criteria for MRI knee was established which will guide the development of other MRI protocols. It is suggested that CEC introduce image quality criteria for MRI to harmonize this complex mode of imaging thus also providing a standard of patient care across departments.

B-1059 15:03

Kinematic X-ray imaging of the hip joint for patients after hip resurfacing arthroplasty and total hip arthroplasty

H. Kawashima, Y. Kajino, T. Kabata, Y. Matsuura, H. Tsuchiya, S. Sanada; *Kanazawa/JP (kawashima1160@gmail.com)*

Purpose: This study aimed to evaluate the usefulness of dynamic radiographs using a dynamic flat-panel detector (FPD) system for patients after hip resurfacing arthroplasty (HRA) and total hip arthroplasty (THA).
Methods and Materials: A total of 27 patients who underwent HRA for 34 hips and 6 patients who underwent THA for 6 hips were included in this study. Sequential images of active and passive flexion in a 45-degree semi-lateral position and active abduction in a supine position were obtained using the FPD system. We examined the imaging findings of impingement between the acetabular component and femoral neck along with cooperative motion at maximal exercise; moreover the central component coordinate of the acetabulum side and femoral head side was measured.
Results: Among the HRA patients, impingement was detected in 20 hips (60%) during flexion and in 2 hips (6%) during abduction. There were no findings of subluxation between the acetabular and femoral components after impingement, but cooperative motion of lumbar and pelvic flexion did occur. In contrast, subluxation was detected during passive flexion in a patient with THA who experienced pain during deep flexion.
Conclusion: We investigated detailed postoperative kinematics of the hip in patients after HRA and THA using a dynamic FPD system. This imaging method facilitated assessments of impingement and cooperative motion, and it can be possibly used for patient lifestyle guidance.

B-1060 15:12

Integrating ultrasound guided MR arthrography in an outpatient institute - the radiographers' role

G. Biró, D. Kovács, Z. Gyevnár, C. Vandulek, I. Repa; *Kaposvár/HU (biro.gergely@sic.ke.hu)*

Purpose: MR arthrography is widely accepted as a diagnostic procedure performed on various joints. Its role is vital in examinations of the shoulder, evaluating rotator cuff tears, capsulolabral complex, rotator interval, glenohumeral ligaments and in certain cases after surgery. As MR arthrography is an invasive examination, including it as a routine examination in an outpatient may be a challenge in many ways - it requires considerate patient, equipment and last but not least, time management - a perfect 'challenge' for a radiographer.
Methods and Materials: Prior to the injection of contrast medium (gadolinium) we perform a native MR scan of the selected joint. Afterwards, with the help of ultrasound guidance (US) we inject 0.1 ml Gd and 10 ml iodine contrast medium mixed with 10 ml saline into the joint. Through the preliminary examinations we aimed to optimise the scanning protocols and examination times. Patient preparation, coil changes etc. were standardised in order to work out a smooth time management profile for MR arthrography.
Results: US guided MR arthrography was introduced in our diagnostic portfolio without noticeable delays for patients and referring clinicians. Radiographers have a key role not only in performing the examinations, but in the patient management phase starting with the arrival of the referral and ending with the finalised medical report.
Conclusion: Through careful planning and mindful time and equipment management, the radiographers contribute to the succesful integration of US guided MR arthrography even in an outpatient institute running with a tight schedule.

B-1061 15:21

Self-assessment of clinical image quality in plain radiography: an evidence-based practice for radiographers

N. Kärnä[1], U.-M. Aakula[1], E. Metsälä[2]; [1]*Hämeenlinna/FI*, [2]*Helsinki/FI (niina.karna@gmail.com)*

Purpose: To carry out the self-assessment of clinical image quality in plain radiography of adult patient's lungs and knee according to best practice.
Methods and Materials: This master's thesis comprised an applied systematic literature review and a study, performed in 2012-2013, which combined a qualitative and quantitative approach. The first stage was to develop an evidence-based best practice for self-assessment of clinical image quality in Kanta-Häme Central Hospital. The content of 19 articles and 151 pages of self-assessment documents and 28 pages of transcribed interviews from three co-operative organisations were analysed for this purpose. The frame for the analysis was constructed from the literature and comprised three main categories: planning and preparation, execution and evaluation. The pilot study of the developed best practice was quantitative. Radiographers and one radiologist from Kanta-Häme Central Hospital used an electronic survey to perform a retrospective self-assessment of radiographs. The assessors' experiences of this self-assessment were examined at the end of the survey.
Results: Very little evidence-based data was found and there seems to be a lack of strong evidence. Practices in self-assessment of clinical image quality in plain radiography were diverse. The description of self-assessed image quality and assessors' experiences of the pilot study are discussed.
Conclusion: There is a need for local, national and global standards for the practice of self-assessment of clinical image quality in plain radiography. These standards could enhance the implementation of systematic and regular self-assessment of clinical image quality. The role of radiographers in self-assessment could be strengthened.

14:00 - 15:30 **Room P**

Molecular Imaging

SS 1806

Clinical and experimental studies

Moderators:
I. Carrió; Barcelona/ES
T. Lammers; Aachen/DE

B-1062 14:00

Correlation of biological characteristics with metabolic information on 11C-methionine PET in primary brain tumours

E. Lopci, L. Bello, F. Raneri, M. Riva, M. Rodari, A. Chiti; *Rozzano/IT (egesta.lopci@gmail.com)*

Purpose: In this study we aimed assessing the relation between biological data and metabolic information as determined by 11C-methionine PET (MET-PET) in patients affected by primary brain tumour and eligible for surgical resection.
Methods and Materials: Overall, we enrolled 54 consecutive patients (M:F=34:20; mean age 45years) affected by pathologically proven gliomas and referred to our Institution for primary surgery. All patients underwent MET-PET and in all cases semi-quantitative analyses were obtained by taking into consideration SUVmax, SUVratio, and Metabolic Tumour Burden (MTB=metabolic tumour volume x SUVmean). MET-PET data were then correlated with biological information including WHO grade/MIB1, isocitrate dehydrogenase 1 gene (IDH1) mutation, 1p/19q co-deletion and O6-methylguanine-DNA methyltransferase (MGMT) promoter methylation.
Results: We analysed 23 low-grade gliomas (LGG: grade II), and 31 high-grade gliomas (HGG: 16 grade III and 15 grade IV). Based on semi-quantitative analyses, we determined a statistically significant correlation between SUVmax, SUVratio and MTB with tumour grading ($p < 0.001$) and could define optimal cut-off points for differentiating LGG and HGG: respectively, SUVmax> 2.8, SUVratio> 2.08 and MTB> 6.63. A statistically significant correlation was found also between tumour uptake and IDH1 mutation, expressed in patients with lower SUVmax (p=0.003) and SUVratio (p=0.002). The correlation was not confirmed for MTB, tumour grade/MIB1 and IDH1 mutation, 1p/19q co-deletion or MGMT methylation.
Conclusion: Metabolic information obtained by MET-PET significantly correlates with histological grading in primary brain tumours. Among other biological characteristics, also IDH1 mutation resulted correlated to tumour uptake, with a prevailing expression in gliomas with lower SUVmax and SUVratio, suggesting a better prognosis in these cases.

B-1063 14:09

Comparison of PET/CT using 11C-choline and 11C-methionine for differential diagnosis of gliomas

Y. Ilyushchenko, A. Panfilenko, L. Tyutin, N. Kostenikov, A. Stanzhevskiy; *St. Petersburg/RU (dr-jurassik@mail.ru)*

Purpose: To compare possibilities of PET with 11C-Choline (CHOL) and (MET) in the differential diagnosis of gliomas.
Methods and Materials: 24 patients with brain tumors (9 cases of glioblastoma, 4 - anaplastic astrocytoma, 6 patients with low grade gliomas and 5 cases of anaplastic oligodendroglioma) were examined by MET and CHOL PET-CT. The standardised uptake values of brain tumors and the T/NT ratios were determined. Histological verification of PET findings was carried out in all cases.
Results: The mean CHOL and MET T/NT ratios in glioblastomas were found to be higher than those in anaplastic astrocytomas (mean±SD: 11.0 ± 3.5 and 2.9 ± 1.07 versus 4.9 ± 2.29 and 1.92 ± 0.33 correspondently, $p < 0.05$). Low grade gliomas showed significantly lower tracer accumulation than the malign astrocytomas in both CHOL and MET studies (2.14 ± 1.08 and 1.5 ± 0.85 correspondently, $p < 0.05$). The CHOL T/N ratio in anaplastic oligodendrogliomas was significantly higher than that in astrocytomas of the same grade (7.82 ± 1.47 versus 4.9 ± 1.07, $p < 0.05$).
Conclusion: CHOL PET can distinguish between malignant and benign gliomas and may be useful in differential diagnosis of anaplastic astrocytomas and ologodendrogliomas.

B-1064 14:18

Simultaneous [18 F] FDG PET/MRI in patients with tumours of the head and neck region: initial results

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Purpose: To evaluate simultaneous [18 F] FDG PET/MRI in patients with tumours of the head and neck region regarding image quality and standardised uptake values (SUVs).
Methods and Materials: Twenty-two patients with tumours of the head and neck region (squamous cell carcinoma: n=17, Adeno-CUP: n=3, adenoidcystic carcinoma: n=2) were examined with simultaneous [18 F] FDG PET-MRI. MR image quality and PET image quality of the PET/MRI scanner were assessed. SUVs were quantitatively analysed by measuring and comparing SUVmax between PET/MRI and PET/CT.
Results: Simultaneous acquisition of MRI and PET data were possible in all patients without artefacts. Quality of MR images and PET images was judged to be good or very good, there was no difference of PET image quality between PET/MRI and PET/CT. The number of detected lesions was equal in PET/MRI and PET/CT. The SUVmax of squamous cell carcinomas was 11.92 (± 6.89) for primary tumours in PET/MRI and 9.54 (± 4.05) in PET/CT (p= 0.048). SUVmax of lymph node metastases of squamous cell carcinomas was 7.83 (± 6.76) in PET/MRI and 6.38 (± 4.71) in PET/CT (p= 0.0064).
Conclusion: Simultaneous [18 F] PET/MRI in patients with tumours of the head and neck region is feasible for routine clinical use. PET image quality of PET/MRI and PET/CT is comparable. Differences of SUVmax between PET/CT and PET/MRI might be explained by biokinetics of [18 F] FDG and differences in attenuation correction of PET/MRI and PET/CT.

B-1065 14:27

Assessment of bone metastases in whole-body [18 F]FDG PET/MRI: comparison to PET/CT

K. Beiderwellen[1], M. Huebner[1], P. Heusch[2], J. Grueneisen[1], V. Hartung[1], F. Nensa[1], H. Kuehl[1], L. Umutlu[1], T.C. Lauenstein[1]; [1]*Essen/DE*, [2]*Düsseldorf/DE (karsten.beiderwellen@uk-essen.de)*

Purpose: To compare the diagnostic value of simultaneous [18 F]FDG PET/MRI with [18 F]FDG PET/CT for the assessment of bone lesions in oncologic patients.
Methods and Materials: 67 patients (28 women, 39 men, age 56±13 years) with solid tumors scheduled for a PET/CT with [18 F]FDG were enrolled for a subsequent whole body contrast enhanced PET/MRI with an integrated scanner. The datasets (PET/CT, PET/MRI) were rated by two readers with regard to bone lesion conspicuity (4-point ordinal scale, 0: not visible - 3: high contrast) and diagnostic confidence (5-point ordinal scale; 1: certainly benign; 2: rather benign; 3: indeterminate; 4: rather malignant; 5: certainly malignant). Median scores were compared using Wilcoxon's rank sum test. A consensus reading based on prior examinations, PET/CT, PET/MR as well as a clinical follow-up of 213±84 days served as standard of reference.
Results: Bone metastases were present in 10 patients (12%), benign bone lesions in 15 patients (22%) and no osseous lesions in 42 (63%) patients. 45 out of 48 bone metastases (94%) were correctly identified by PET/CT, whereas a correct identification of all bone metastases was possible based on PET/MRI. Lesion conspicuity for metastases was high for both modalities with significantly higher results using PET/MRI ($p < 0.05$). Diagnostic confidence in metastases was high for both modalities as well, yet without any significant difference. In contrast, for benign lesions conspicuity was significantly higher on PET/CT ($p < 0.05$).
Conclusion: Integrated PET/MRI with [18 F]FDG shows a high potential in the assessment of bone metastases and might serve as valuable alternative to PET/CT.
Author Disclosures:
H. Kuehl: Speaker; Siemens Healthcare.

B-1066 14:36

Quantitative evaluation of bone metastases from prostate cancer with simultaneous (18 F) choline PET/MRI: combined SUV and ADC analysis

A. Wetter, C. Lipponer, F. Nensa, T. Schlosser, T. Pöppel, T.C. Lauenstein, J. Nagarajah; *Essen/DE (axel.wetter@uk-essen.de)*

Purpose: Quantitative analysis of bone metastasis from prostate cancer with correlation of apparent diffusion coefficients (ADC) and standardised uptake values (SUVs).
Methods and Materials: 67 patients with biopsy proven prostate cancer or suspected recurrent prostate cancer were examined with simultaneous 18 F PET/MRI. In 11 patients, altogether 32 PET positive bone metastases could be identified that were located in the field-of-view of the DWI-sequence. Region-of-interest (ROI) analyses were performed to measure the average and minimal ADCs and to assess maximum and mean SUVs of every bone lesion.

Correlations between maximum and mean SUVs and average and minimal ADCs were calculated.
Results: The SUVmax of all lesions was 5.5 ± 3.13 (mean ± SD). The SUVmean was 1.75 ± 0.91. The average ADC (ADCaver) of all lesions was 666.45 ± 133.18 x 10-3 mm2/s. The minimal ADC (ADCmin) of all lesions was 564.24 ± 135.19 x 10-3 mm2/s. There was a moderate but significant inverse correlation of SUVmax vs. ADCaver with a correlation coefficient of -0.4 (p = 0.02). There was also a significant inverse correlation of SUVmax vs. ADCmin with r = -0.41 (p = 0.02).
Conclusion: Our results demonstrate a moderate but significant inverse correlation between increased choline metabolism and ADC values of bone metastases from prostate cancer. There is a possible complementary value of DWI and choline PET for further characterisation of bone lesions in prostate cancer patients. Further research on a multimodality approach using simultaneous PET/MRI in bone metastases of prostate cancer seems to be justified.

B-1067 14:45

Role of (18)F-sodium fluoride PET/CT in characterising osteoblastic prostate cancer skeletal metastases

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Purpose: To evaluate the diagnostic values of 18 F-sodium fluoride (NaF) positron emission tomography/computed tomography (PET/CT) imaging to characterise osteoblastic prostate cancer skeletal metastases and to distinguish them from benign processes.
Methods and Materials: One hundred and ten patients (56-82 y.o., mean age 69 yrs) with biopsy proven adenocarcinoma of the prostate underwent standard PET/CT imaging from vertex to toes approximately 45-60 minutes after the intravenous administration of 370±37 MBq of 18NaF. Gleason grading, serum prostate specific antigen levels (PSA), radiotherapy (RT), hormone, surgical or chemotherapy treatments were recorded. One spine lesion and one pelvic lesion were selected as index lesion per subject, and the maximum standardised uptake values (SUV (max)) were calculated as a semiquantitative surrogate measure for osteoblastic activity.
Results: The SUV (max) of metastasis was significantly higher than chronic degenerative disease ($p < 0.001$). In those who did not undergo any treatment, the SUVmax was not significantly different between pelvis and spine metastasis (p=0.19).No statistical difference was found in SUV max between subgroups separated by Gleason grading, serum PSA levels or TNM staging. The SUV (max) of pelvic metastasis was significantly lower in patient status post radiation therapy (p=0.049). The SUV (max) of both pelvic and spine metastasis were not significantly lower in patients treated with antiandrogen. However, a trend characterised by lower SUV max values was demonstrated (p=0.08).
Conclusion: Our preliminary data suggests that semiquantitative measurements of 18NaF activity with PET imaging can be useful in detection of active skeletal metastasis in patients with prostate adenocarcinoma. Importantly,18NaF PET imaging can accurately distinguish between benign chronic degenerative changes and metastatic involvement.

B-1068 14:54

The impact of F18 choline PET/CT in the biochemical relapse of prostate carcinoma: a retrospective analysis in a large collective

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Purpose: Relapse in prostate cancer after 10 years occurs in 20-50% of surgically treated and in 30-40% of radiated patients with increased PSA. An early differentiation between local relapse and systemic progression is important, as in local relapse further curative therapy is possible. In case of local disease, focused therapy such as radiation can delay hormone therapy. Aim of this retrospective study is to analyse the impact of F18 Choline PET/CT in relapse diagnosis of primarily successfully treated prostate carcinoma.
Methods and Materials: Between 2007 and 2013, we analysed 196 investigations in 165 patients. Some patients had more than one relapse. Patients with unsuccessful primary therapy and patients under hormone therapy were excluded.
Results: Recurrence in the prostate fossa was found in 15% of cases, PSA range 0.88 - 13, mean 4.54. Local lymph nodes were involved in 15% of cases, PSA range 0.21 - 27, mean 3.7. Distant metastases were detected in 54% of cases, PSA range 0.1 - 75.5, mean 5.18. No correlation was found in 16% of cases, PSA range 0.02 - 13.14, mean 2.6. In 18 cases therapy was confirmed by the PET/CT result. In 42 cases therapy strategy changed and in 5 cases intention (curative/palliative) changed.
Conclusion: Choline PET/CT is valuable for identification of biochemical relapse in cancer of the prostate and can find potentially curable cases. A correlation can be identified even for low PSA concentrations of < 0.2 ng/ml. In spite of high PSA concentrations of > 13neg/ml some cases showed no metabolical or morphological correlation.

B-1069 15:03

Hybrid 18 F-fluoride PET and MR imaging of the spine - a pilot study and comparison of signals in patients with axial spondyloarthritis

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Purpose: This study was performed as a pilot study on simultaneous 18 F-F-PET/MRI of the spine in patients with axial spondyloarthritis (axSpA). PET/MRI data were compared to MRI alone in order to evaluate whether 18 F-F-PET provides additional information to MRI alone.
Methods and Materials: In 11 axSpA patients, median age 39 years, disease duration range 0.5-10 years, mean Bath ankylosing spondylitis disease activity index 5.3, 18 F-F- PET/MRI was performed 40 minutes after injection of a mean dose of 157 MBq Fluoride using a hybrid whole-body PET/MRI scanner. MRI data alone and fused 18 F-F- PET/MRI data sets were scored by two blinded readers using the Berlin MRI score and by recording inflammatory PET and MRI lesions on a vertebral edge (VE) level.
Results: Acquisition of whole-spine 18 F-F PET/MRI scans was successful in all patients. The mean Berlin MRI score was 6.8 (range 0 - 31). Inflammatory findings were consistent on both, MRI and 18 F-F-PET/MRI, in 90% of the involved sites. In the remaining 10 %, focal 18 F-F-uptake without correlating MRI pathology was detected. Current evaluations are aimed at characterising these discrepant findings. At presentation we are going to present data on the clinical relevance of the above named discrepancies between 18 F-F-PET/MRI and MRI alone.
Conclusion: 18 F-F- PET/MRI of the spine provides additional metabolic information on inflammatory bone lesions in axSPA patients compared to MRI alone. The clinical relevance of these additional findings is currently under investigation.

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Assessment of ^{68}Ga DOTATOC uptake in neuroendocrine cancer patients undergoing PRRT to improve therapeutic stratification - a retrospective response analysis

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Purpose: The goal of our investigation was to assess the somatostatin receptor (SSR2) expression by determining SUVmax in the liver metastases that will be most beneficial for patients with neuroendocrine tumours (NETs) undergoing peptide-related radionuclide therapy (PRRT).
Methods and Materials: 30 patients with 60 hepatic metastases of NETs were evaluated in the retrospective study. Patients were divided into responders and non-responders according to structural lesion changes. The response was determined on a lesion-by-lesion basis evaluating morphological changes in tumour size between baseline and follow-up CE-CT after three cycles of PRRT. SSR2-expression of liver metastases in both groups was assessed at baseline [SUV maximum (SUVmax), metastases-to-spleen SUV ratio (SUVm/s) and metastases-to-liver SUV ratio (SUVm/l)].
Results: There was a statistically significant difference between the mean SUVmax of morphologically non-responders vs. responders prior PRRT in the initial ^{68}Ga DOTATOC PET/CT. The mean SUVm/s (1.20±0.37 vs.1.90±0.45, $p < 0.05$) and mean SUVm/l (3.15±0.53 vs.4.97±0.62, p=0.0003) also showed statistically significant difference between the non-responders and responders. We observed also statistically significant difference in the SUVm/s ratio prior and after treatment in the responders patients. The longest diameter on CE-CT of the lesions was determined and in the non-responders there was no statistically significant difference pre and post three cycles of the PRRT. In the group of the responders there was statistically significant difference between the LD on CE-CT pre and post therapy (2.96±0.40 vs.1.58±0.43, p =0.00001).
Conclusion: In this retrospective study, our data suggest that mean SUVmax is a useful prognostic biomarker to improve patient selection undergoing PRRT.

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Perfusion-MRI and 18-FDG-PET for monitoring the effects of regorafenib on experimental colorectal carcinomas in rats with immunohistochemical validation

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Purpose: To investigate a multimodal, multiparametric perfusion MRI / 18 F-FDG-PET imaging protocol for monitoring regorafenib therapy effects on experimental colorectal adenocarcinomas in rats with immunohistochemical validation.

Methods and Materials: Human colorectal adenocarcinoma xenografts (HT-29) were implanted subcutaneously in n=17 (n=10 therapy group; n=7 control group) female athymic nude rats (Hsd:RH-Foxn1rnu). The animals were imaged at baseline and after a one-week daily treatment with regorafenib (10 mg/kg bodyweight) using a multimodal, multiparametric perfusion MRI / 18 F-FDG-PET imaging protocol. In perfusion MRI, quantitative parameters of plasma flow (PF, mL/100 mL/min), plasma volume (PV, %) and extraction flow (EF, mL/100 mL/min) were calculated. In 18 F-fluoro-deoxyglucose-(18 F-FDG)-PET, tumor-to-background-ratio (TTB) was calculated. Perfusion MRI parameters were correlated with TTB and immunohistochemical assessments of tumor angiogenesis (CD-31) and cell proliferation (Ki-67).

Results: Regorafenib significantly ($p < 0.01$) suppressed PF (80.9±7.9 to 51.1±16.9 mL/100 mL/min), PV (12.1±3.8 to 7.7±1.6 %) and EF (13.9±3.2 to 8.2±2.2 mL/100 mL/min) as well as TTB (3.4±0.6 to 1.9±1.1) between baseline and day 7. Immunohistochemistry revealed significantly ($p < 0.03$) lower CD-31 (8.5±3.2 vs. 14.9±5.3) and Ki-67 (500.6±102.3 vs. 596.3±55.5) in therapy group than in control group. Perfusion MRI parameters ΔPF, ΔPV and ΔEF showed strong and significant ($r=0.64-0.77; p < 0.01$) correlations to the PET parameter ΔTTB and moderate, but significant correlations ($r=0.49-0.57; p < 0.05$) to immunohistochemical Ki-67. ΔPF and ΔPV also correlated moderately to the CD-31-stainings ($r=0.49-0.53; p < 0.05$).

Conclusion: A multimodal, multiparametric perfusion MRI / PET imaging protocol allowed for monitoring regorafenib therapy effects on experimental colorectal adenocarcinomas with significant correlations between perfusion MRI parameters and 18 F-FDG-PET, as validated by immunohistochemistry.